# CAPTIVE PROPAGATION FOR RECOVERY OF SPECIES UNDER ESA

4. M 53: 103-88

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# HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT
AND NATURAL RESOURCES

OF THE

COMMITTEE ON
MERCHANT MARINE AND FISHERIES
HOUSE OF REPRESENTATIVES

ONE HUNDRED THIRD CONGRESS

FIRST SESSION

ON

**THE ROLE THAT CAPTIVE BREEDING SHOULD PLAY IN FUTURE EFFORTS TO CONSERVE SPECIES**

MARCH 1, 1994

**Serial No. 103–88**

Printed for the use of the Committee on Merchant Marine and Fisheries

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# CAPTIVE PROPAGATION FOR RECOVERY OF SPECIES UNDER ESA

**TUESDAY, MARCH 1, 1994**

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES, COMMITTEE ON MERCHANT MARINE AND FISHERIES,

*Washington, DC.*

The Subcommittee met, pursuant to call, at 10:08 a.m., in room 1334, Longworth House Office Building, Hon. Gerry E. Studds [chairman of the subcommittee] presiding.

Present: Representatives Studds, Furse, Tauzin.

Staff Present: Sue Waldron, Press Secretary; Lesli Gray, Professional Staff; David Hoskins, Counsel; Marvadell Zeeb, Clerk; Margherita Woods, Minority Clerk; Sharon McKinney, Minority Counsel; Harry Burroughs, Minority Staff Director; Cynthia Wilkinson, Minority Counsel, Dan Ashe, Staff Director, and Liz Megginson, Staff Director/Chief Counsel, Coast Guard Subcommittee.

## STATEMENT OF HON. GERRY E. STUDDS, A U.S. REPRESENTATIVE FROM MASSACHUSETTS, AND CHAIRMAN, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES

Mr. STUDDS. We can come to order. This morning, the subcommittee will examine captive propagation, an important tool in the recovery of species such as the California condor, the peregrine falcon, and the red wolf.

This is almost always controversial because it is essentially an admission that a species has declined to a point where natural reproductive processes alone cannot support recovery. It is a decision essentially to augment the miracle of Mother Nature with the power of human technology.

As we know from medicine, technology can be a powerful ally, but it can become a crippling and expensive dependency. It is difficult to predict where one ends and the other begins.

Today's hearing is not about whether captive propagation can be useful in the recovery of endangered species because clearly it has been. It is about when and to what degree it should be used. Should it be only a measure of last resort, or should it be an integral element of all recovery efforts? Do we need clearer policy to guide our decisions on the use of this tool?

Today's witnesses have concrete experience in captive breeding efforts, and I hope we will hear some constructive recommendations on the role that captive breeding should play in future efforts to conserve species.

Mr. STUDDS. Does the gentlewoman have an opening statement? Please. The gentlewoman from Oregon.

## STATEMENT OF HON. ELIZABETH FURSE, A U.S. REPRESENTATIVE FROM OREGON

Ms. FURSE. Thank you, Mr. Chairman. I am pleased to be here this morning to hear this testimony. I feel that captive propagation can in certain circumstances be a very useful tool in assisting the recovery of endangered and threatened species. However, it is important that captive propagation is used in the context of a comprehensive recovery plan that addresses all aspects of a species' life cycle. Captive propagation should not be used as a substitute for other more important recovery measures such as habitat conservation that will assure that a species can live and breed in its natural environment, but it is clearly within the language of the Endangered Species Act as a tool for recovery. Thank you, Mr. Chairman.

Mr. STUDDS. I thank the gentlewoman. Just a word, if I may, about procedure. We have six witnesses. We are going to treat you as a single panel and hear all of your testimony prior to going to questions of you as a panel. A couple of things. We will ask you, as I trust you have already been alerted by staff, to confine your oral presentations to no more than five minutes. We are brutally rude about that. We have a little set of lights up there which will help guide you to your 5-minute conclusion. The yellow light will be your 1-minute warning, and the red light will inform you that you have completed your testimony. We apologize for that.

We do extend the same rule to ourselves because the laws of physics are such that we would not otherwise get through what we have to get through, and there are a lot of folks with a lot of things to say. Your written testimony will appear in its entirety in the record, and future historians will never know you didn't read every word of it. We will treat you with one exception, in the order in which you appear on the list, we are going to make Dr. Gary Matlock first and Mr. Michael Spear second. That is our one change.

And I should apologize in advance. After Dr. Matlock's testimony, I am going to have to leave somewhere between briefly and for the rest of the morning to, among other things, consult with Dr. Matlock. He shall return whether or not I do. He will return, and other members will have to trade off on the Chair. We have a series of simultaneously accelerating crises, which is to say it is a normal morning. So we will begin first with Dr. Matlock of the National Marine Fisheries Service. Dr. Matlock.

## STATEMENT OF DR. GARY MATLOCK, DEPUTY REGIONAL DIRECTOR OF THE SOUTHWEST REGION, NATIONAL MARINE FISHERIES SERVICE

Mr. MATLOCK. Thank you, Mr. Chairman and members of the Subcommittee. I appreciate this opportunity to inform you of the Department's views on the use of captive propagation to assist in the recovery of species listed under the Endangered Species Act (ESA).

For more than a century, the National Marine Fisheries Service (NMFS or Fisheries Service) and its predecessors have been in-

volved in captive propagation of marine species. The ESA recognizes that captive propagation may be a useful tool for the conservation and recovery of threatened and endangered species. However, the ESA emphasizes the need to conserve species in their natural habitats. The Fisheries Service supports captive propagation programs for some listed species but only as a last resort for recovery purposes.

Currently, the Fisheries Service and the U.S. Fish and Wildlife Service are jointly developing a cooperative policy for controlled propagation of species listed under the ESA to provide guidelines for the use of captive propagation for listed animals and plants. These policies are necessary because there are a number of genetic and ecological risks associated with captive propagation. They include but are not restricted to the following: The decline or extinction of the wild population because of the removal of adults for broodstock; domestication in captivity which may diminish the ability to survive and reproduce in the wild after release; disease transfer between captive and wild populations; the displacement of wild populations through increased competition for food, space, and mates with captively reared individuals; inbreeding in captive and wild populations resulting from the enhancement of only a portion of the gene pool; reduction in genetic variability of the wild population due to swamping of those populations with captively reared individuals; and erosion of genetic differences between populations.

It is not always clear, however, that captive propagation will facilitate conservation and recovery efforts under the ESA. For example, at this time, we do not know if sea turtles raised in captivity and released in the wild assist recovery efforts. For this reason, the Fisheries Service does not support the use of captive propagation of endangered sea turtles. Our efforts with the Kemp's ridley sea turtle best illustrate this uncertainty.

From 1980 through 1988, the Fisheries Service collaborated with the Cayman Turtle Farm on a captive breeding program for the Kemp's ridley sea turtle. The goal of the program was to breed Kemp's ridleys in captivity and establish a captive breeding population. The farm has had very limited success breeding Kemp's ridleys. For example, only 30 percent of the female Kemp's ridleys bred in captivity. These breeding females laid fewer clutches than their wild counterparts, fewer eggs per clutch, and most of the eggs were either infertile or did not develop fully during incubation.

Also, there have been no published reports on the growth and survival of the hatchling Kemp's ridleys produced at this farm. In addition, their ability to survive in the wild has not been determined. If captive-bred sea turtles cannot reproduce in the wild, they will not contribute to the recovery of the species.

NMFS' Kemp's Ridley Headstart Program, an experiment designed to determine if it is possible to increase the numbers of this critically endangered species in the wild population, has had limited success. The first phase of the program was conducted from 1978 until 1993. During that phase, eggs or hatchlings were taken from their natural beach at Rancho Nuevo, Mexico, and reared in captivity for about 9 months and then released in the Gulf of Mexico. The program produced useful information on sea turtle husbandry, behavior, and physiology. However, we cannot yet deter-

mine the effectiveness of this program because we do not know how successful headstart turtles have been in the wild.

In an effort to remove this uncertainty, we began Phase II last year. During this phase, we will evaluate the success of the experiment by measuring the survivorship and fecundity of about 16,000 turtles that were released during 1985 through 1993. We are following this strategy as it was recommended by the most recent independent review of the headstart experiment.

Headstart is not a proven conservation technique for the recovery of sea turtles and should not be viewed as such until we can determine the success of our headstart experiment. There is evidence that shows headstart turtles survive, grow, and use the same habitats where Kemp's ridleys in the wild occur. There is also evidence which raises concerns about their ability to adapt to the wild.

Headstart turtles suffer disproportionately high mortality during the first 12 months in the wild. Some display maladaptive behavior that may be a consequence of their being raised in a protected environment during a critical phase of their development.

In summary, the Fisheries Service only supports the use of captive propagation to assist in the recovery efforts of listed species as a last resort, when identified by a recovery team of experts, if the genetic and ecological risks are minimized, if adequate monitoring is included, and other recovery actions that address the causes of a species decline are also implemented.

With that, Mr. Chairman, thank you very much. Again, it is a pleasure to be here, and I will be glad to answer questions when I return.

[Statement of Dr. Matlock can be found at the end of the hearing.]

Mr. STUDDS. Thank you very much, Dr. Matlock. You are momentarily excused. I am going to ask the distinguished gentlewoman from Oregon if she will temporarily assume the Chair and call on Mr. Michael Spear of the U.S. Fish and Wildlife Service. Mr. Spear.

## STATEMENT OF MICHAEL SPEAR, ASSISTANT DIRECTOR FOR ECOLOGICAL SERVICES, U.S. FISH AND WILDLIFE SERVICE

Mr. SPEAR. Thank you, Mr. Chairman, members of the subcommittee. I am pleased to be here today and to have this opportunity to share with you the Fish and Wildlife Service's views on propagation and to report on the status of the joint Service/National Marine Fisheries Service interagency policy currently under consideration on propagation of species listed under the Endangered Species Act.

For the purpose of this testimony, I would like to use the term propagation rather than captive propagation. Within the context of the interagency policy, the use of the term propagation allows both Services to address a wider array of techniques presently and potentially available to biologists for use in the propagation of listed animals and plants.

Propagation allows the inclusion of techniques that do not necessarily require the captivity or temporary maintenance of the plants or animals being manipulated. Therefore, under the interagency policy under consideration, propagation would include the

enhancement or suppression of fertility, mating, transfers of gametes or embryos, development of offspring, and grow-out of animals when intentionally confined or directly manipulated by humans in the wild. Propagation of plants using seeds, spores, callus tissue, divisions, cuttings, or other plant tissue under managed conditions is also included in this definition.

Propagation can be a vital tool for aiding species recovery. Significant successes include the improving status of the peregrine falcon, red wolf, greenback cutthroat trout, black-footed ferret, California condor, and whooping crane. Among plants, propagation is assisting the recovery efforts for numerous species including the green pitcher plants, endangered cacti, and several of Hawaii's endangered native flora. And I notice on the wall you have pictures of a couple of these examples of plants that I have mentioned. For plants, propagation is especially important because of the generally low cost in comparison to propagation of animals and the critically low numbers of individuals of many listed plant species.

As far as success stories, in 1975, it was estimated there were 60 pairs of peregrine falcons in the wild within the United States. By 1991, that estimate had been revised upward to 700 pairs. The combined elimination of organochloride pesticides and a vigorous propagation and release program has brought this bird to the point where reclassification to threatened status is being considered.

In 1975, on the verge of extinction with only 14 animals in the wild, the last remaining red wolves were captured. Red wolves are being successfully bred in captivity and once again are breeding in the wild. Red wolf reintroductions have been successful at the Alligator River National Wildlife Refuge in North Carolina and the Great Smokey Mountains National Park.

In 1937, it was thought that the greenback cutthroat trout might be extinct. However, two small populations were discovered in western Boulder County, Colorado. Recovery efforts, including propagation for this species, began in 1959 through a cooperative effort between Federal, tribal, and State agencies. With the enactment of the Endangered Species Act, the fish was listed as endangered and a recovery team was established. Continued propagation recovery progress is being made and has already resulted in downlisting the species from endangered to threatened.

In 1986, after years of discussion, Federal and State officials agreed to place the last five California condors in captivity. The last wild bird was captured in 1987. Propagation programs were initiated at the Los Angeles Zoo and the San Diego Wild Animal Park. In 1993, birds were released into the Sespe Refuge. Because of unexpected mortalities, survivors of the initial release were recaptured and released along with additional birds in safer habitat. The released birds are doing well at the new site, and extinction of this massive and magnificent bird has been avoided.

There are problem areas however. It cannot be stressed too strongly that while propagation definitely has a supportive role in recovery of some species, it is not a substitute for recovery of listed species in the wild. The Endangered Species Act clearly states that its intent is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Therefore, it has long been interpreted that the man-

date of the Service is to recover wild populations in native habitats whenever possible.

I reference the intent of the ESA to conserve and restore habitat because another issue of concern to the Service is the notion that propagation can be used in a manner analogous to factory production, an "if you need more, make more" approach. The suggestion that species currently at the center of perceived resource-versus-economic controversies should be propagated and in essence stockpiled so that they are no longer at risk of extinction is fundamentally inconsistent with good resource management and the intent of the ESA.

If the use of propagation is to reach its full potential for contributing to the recovery of listed species, it must be part of a clearly defined and ongoing recovery program that meets the needs of endangered and threatened species and ecosystems upon which they depend. Criteria by which species' recovery is judged are not based on numbers alone.

I would like to talk about the policy now. At this time, the Service and our cooperators—States, tribes, and nongovernmental organizations—are involved in the propagation or maintenance of more than 200 species. Because of the anticipated expansion in recovery-oriented propagation, a policy providing guidance on this issue has been clearly needed.

Reasons for initiating propagation efforts include avoiding species' extinctions, maintaining genetic vigor, maintaining refugia populations, providing individuals for establishing new self-sustaining populations, supplementing or enhancing extant populations, and filling life cycle gaps created by habitat changes.

The interagency policy currently under consideration identifies specific requirements that must be met prior to the implementation of propagation for purposes of plant or animal production for recovery. The major requirements being considered are: With limited exceptions such as emergency situations and research, propagation must be identified as a recovery action in a final approved recovery plan for the species; appropriate analyses and safeguards protecting the species must be met such as the development of genetic management plans and population viability analyses when appropriate; initiation of propagation for purposes of stocking, supplementing, or creating new populations must be approved by the director of the responsible agencies; propagation for supplementation and reintroduction must be preceded by appropriate actions to secure adequate habitat; and there will be substantive but reasonable reporting of activities, accomplishments, and expenditures on an annual basis to the directors.

Unless these fundamental conditions can be met, propagation would not likely be sanctioned. Thank you for your time and consideration. If there are any questions, I would be happy to address them.

[Statement of Mr. Spear can be found at the end of the hearing.]

Ms. FURSE. [presiding] Congressman Fields and Congressman Saxton both have statements that they would like to have placed in the record and without objection it is so ordered.

[Statement of Mr. Fields follows:]

STATEMENT OF HON. JACK FIELDS, A U.S. REPRESENTATIVE FROM TEXAS, AND RANKING MINORITY MEMBER, COMMITTEE ON MERCHANT MARINE AND FISHERIES

Mr. Chairman, I welcome the opportunity to participate in today's hearing and to receive testimony on the role of captive propagation in the conservation and recovery of threatened and endangered species. I am also pleased that we will be receiving testimony concerning the Kemp's ridley sea turtle headstart program, which is an effort I have strongly supported for over a decade.

Mr. Chairman, as you know, I am a strong proponent of captive propagation, specifically when it can be used as an effective tool in restoring threatened and endangered species. As you may recall, last year the House of Representatives adopted my bill, H.R. 3402, directing a research effort into the captive propagation of fountain darters in my home State of Texas. I see no reason why the U.S. Fish and Wildlife Service cannot propagate this species in captivity and release it back into the wild to help in the recovery of this population.

Captive propagation has been used effectively in the recovery of a number of endangered species, including the peregrine falcon, whooping crane, California condor, red wolf, sea turtles, several species of fish, and, most recently, the black-footed ferret.

It has a proven track record of success and, within the incentives that Billy Tauzin and I have included within H.R. 1490, I am convinced that captive propagation can play an increasingly important role in the future.

Furthermore, I believe the testimony we will hear from Mrs. Carol Allen, the president and founder of HEART, concerning the role her fine organization has played in the recovery of Kemp's ridley turtles, will be a good illustration of how captive propagation, including its research and educational benefits, can assist in the recovery of endangered species.

Finally, last year, I joined with our colleagues, Solomon Ortiz and Billy Tauzin, in urging the National Marine Fisheries Service to continue its policy of allowing certain Kemp's ridley hatchlings to be transported to the Headstart Program in Galveston, Texas. Sadly, the Agency chose not to take our advice, and I believe that was a terrible mistake. It is my hope that we can reverse this policy because the turtle Headstart Program is, in my judgment, an important factor in the long-term survivability of this species.

Mr. Chairman, I join with you in welcoming our distinguished witnesses and look forward to hearing their testimony.

Thank you, Mr. Chairman.

[Statement of Mr. Saxton follows:]

STATEMENT OF HON. H. JAMES SAXTON, A U.S. REPRESENTATIVE FROM NEW JERSEY, AND RANKING MINORITY MEMBER, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES

Good morning. I am pleased that we will be discussing the use of captive propagation in the conservation and recovery of threatened and endangered species. There is a question as to the effectiveness of this practice and today's hearing should go a long way in discovering what biological, economic, and political factors determine the method's success.

In my own district, the State of New Jersey and the U.S. Fish and Wildlife Service have been active in preserving piping plovers at various units of the Edwin B. Forsythe National Wildlife Refuge.

It is my understanding that this method has been successful in the Barnegat Light unit of the Forsythe, however, the Holgate unit, less than 18 miles away, does not exhibit the same success.

I am hopeful that this hearing will shed light on the varying degrees of successful propagation. From this input, perhaps we can determine whether this method of recovery should be expanded. Some of my constituents have also exhibited interest in why the Kemp's ridley sea turtle head start program was discontinued, so I look forward to hearing more about that issue from our witnesses.

Ms. FURSE. Ms. Allen.

**STATEMENT OF CAROLE H. ALLEN, CHAIRPERSON, HELP ENDANGERED ANIMALS-RIDLEY TURTLES [HEART], HOUSTON, TEXAS**

Ms. ALLEN. Thank you for the opportunity to testify on behalf of HEART (Help Endangered Animals-Ridley Turtles). I am here because last July the United States turned down 2,000 Kemp's ridley hatchlings, a gift from the Mexican people to the American people since 1978. That stopped headstarting by National Marine Fisheries Service at Galveston, Texas.

HEART is a grassroots, all-volunteer organization founded in 1982 to support the government's program to save the Kemp's ridley from extinction. We have raised public awareness and over $100,000 for headstarting, turtle food, a new turtle house, and equipment for Galveston, generators, and all-terrain vehicles for the Mexican turtle camp, funding for graduate research, and education for students and teachers. My comments today are from longer remarks I sent in advance for the official record. I hope you all get a chance to look at it.

First of all, we must have TEDs. In 1989, Congress asked the National Research Council for a study on sea turtles. It states, "Headstarting should be maintained as a research tool, but it cannot substitute for other essential conservation measures." We totally agree. We will always oppose a philosophy that condones drowning sea turtles in shrimp nets or in any kind of fishing gear when conservation measures exist to prevent it.

The July 15 Dane memorandum from the Fish and Wildlife Office of Scientific Authority and a letter from Permits Chief Saito four days later killed headstarting. Both contain incorrect and incomplete information. Legislators and taxpayers have not been told the whole truth. Both documents imply that since the experiment started in 1978, headstarted turtles should already be nesting. How could they not mention that mostly male turtles were hatched until 1985? Just 3 years after the error was corrected, Fish and Wildlife stopped the hatching and imprinting program at the Padre Island National Seashore. They continue to expect headstarted turtles to nest years before they are mature.

In 1989, the scientists who recommended the experiment continue 10 years after TED use were well experienced with headstarted Kemp's ridleys. In 1992, a different committee said to stop raising turtles and start looking for them. I challenge both NMFS and Fish and Wildlife to tell us today exactly all that has been done since then to find headstarted turtles.

The Saito letter says the Kemp's Ridley Recovery Plan recommends against headstarting. Not true. It only recommends against additional headstart experiments. Headstarting is not a priority task in the plan, and that is a black mark against it. But projects that are listed are being neglected such as the sea turtles stranding network, patrolling beaches at Padre Island, doing TED research in Mexican waters. HEART is still being asked for money to do these things.

NMFS raised the hatchlings in buckets and then released them miles offshore. Why not a protected bay so they could adapt and work their way out? Only turtles destined for TED testing were conditioned for release. Saito wants tangible results of

headstarting. The Texas A&M University research we sent last summer shows that headstarted turtles make up 13 percent of the Kemp's population in the research area.

The Rudloe article in the January National Geographic mentions headstarted and wild ridleys mingling in Florida waters. A December 1, 1993, letter from Fish and Wildlife expresses concern about taking eggs or hatchlings from Mexico and the cumulative effect and then adds, "Without any proof, we are only guessing." Eggs from captive breeding could be used, but Fish and Wildlife has released most of the adult turtles except a few at Sea World and San Antonio and in the Cayman Islands.

Fish and Wildlife tells us they have "more optimism for recovery of the species." Last year we lost 12 adult female ridleys in shrimp nets in Mexican waters near the nesting beach, a hundred young ridleys along the Louisiana coast, and shrimpers tied the TEDs shut in Texas. The cost of headstarting is criticized, but we can't find out how much it is, and we paid a Freedom of Information Act charge to get that information.

Dane shows the inter- and intra-agency squabbling that has gone on with this program. Shouldn't the United States set the criteria for headstarting for the world? When Dr. Bill Fox was NMFS Director, he supported headstarting. But NMFS didn't appeal the Fish and Wildlife decision last summer.

In closing, HEART members ask this Committee to do everything possible under the Endangered Species Act to save this turtle from extinction including limited headstarting even if some officials have a bias against it. It has not been given a fair chance. People who have donated money and paid taxes for this experiment deserve a lot more than its sudden, unjustified termination. We hope headstarting will be restarted this summer with 2,000 hatchlings at Galveston. Thank you very much.

[Statement of Ms. Allen can be found at the end of the hearing.]

Ms. FURSE. Thank you for your very compelling testimony. Mr. Woody.

## STATEMENT OF JACK B. WOODY, SEA TURTLE BIOLOGIST, RIO RANCHO, NEW MEXICO

Mr. WOODY. Thank you. It is a pleasure to be here again today and for the opportunity to discuss the propagation of threatened and endangered species as a recovery tool. I understand the primary reason for my presence here today is to discuss propagation of the endangered Kemp's ridley sea turtle.

Captive propagation of fish and wildlife, endangered or not, has a place in resource management. But we must remember what our objectives really are. It is a popular tool. It appears to make good sense. Animals in captivity can usually be viewed by the public, and we are all led to believe that the propagation purpose is to return animals to their natural environment which is seldom successful. It sounds great, but what happened that would cause such a decline in a wild species that necessitated such costly and drastic last ditch measures as artificial propagation? If these factors have not been identified and corrected, we are kidding ourselves. We can raise ridleys, elephants, or condors until we are blue in the face,

and it will be absolutely meaningless to the species' survival in the wild.

Insofar as the survival and recovery of the Kemp's ridley is concerned, and I have stated this on previous appearances before this Committee, the key survival and recovery actions required are the continued protection of the Mexican nesting beach by Mexico with the cooperation of the Fish and Wildlife Service and 100 percent use of turtle excluder devices by the United States and Mexican shrimp fleets. Without these key actions, everything else will be a waste of time and money and further detract from these real problems.

Captive propagation of the Kemp's ridley or any sea turtle species as a recovery action would be a hoax to evade the real problems these animals face in their fight for survival.

Legislation which directs or encourages propagation as a recovery tool must be suspect, for such legislation is totally unnecessary. The Fish and Wildlife Service already has this authority and is engaged in a number of such efforts. Legislation to highlight such a technique would only serve to emphasize a single tool, often of questionable value, high cost, and often catering to special interests while further detracting from the real problems of habitat degradation, loss, and other threats which must be given priority above all else. Thank you for this opportunity.

[Statement of Mr. Woody can be found at the end of the hearing.]

Ms. FURSE. Thank you. Mr. Choromanski.

**STATEMENT OF JOSEPH M. CHOROMANSKI, ASSISTANT DIRECTOR OF HUSBANDRY, AQUARIUM OF THE AMERICAS, AUDUBON INSTITUTE, INC., NEW ORLEANS, LOUISIANA**

Mr. CHOROMANSKI. Thank you, Mr. Chairman and members of the Subcommittee, for providing the Audubon Institute the opportunity to comment on this critical issue.

The primary goal of conservation is to preserve wildlife in its natural state whenever possible, and, therefore, captive propagation should not be viewed as a panacea for the endangered species problem. Captive propagation as a conservation measure has many associated problems and limitations and carries with it some serious inherent genetic and ecological risks.

On the other hand, captive propagation plays a role and is a tool in the zoo and aquarium arena where endangered animals are maintained and used for public education and conservation research. And captive propagation is a conservation tool actively utilized by many of the facilities of the Audubon Institute including the Freeport-McMoRan Audubon Species Survival Center.

The Kemp's ridley is indisputably the most endangered species of sea turtle in the world today. Many threats, both historical and present day, have led to this critical status as outlined by the recovery plan for the Kemp's ridley sea turtle produced jointly by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service.

This species recovery plan, however, does not include any form of captive propagation, even as a low priority task, or even restricted to continuing basic reproductive research. And although maintaining captive stocks is included in the plan as a recovery

task, it is given the lowest priority level. Considering that we recently experienced the largest known mass mortality of Kemp's ridley sea turtles in Louisiana this past summer, and that all of these animals were valuable juveniles, these priorities might need to be reconsidered to take into account the real potential of catastrophic loss.

The Audubon Institute, however, in no way endorses any type of captive propagation of sea turtles or any endangered species solely for mass production for release or reintroduction back into the environment without concomitant conservation programs involving habitat and population protection. These concomitant conservation programs would include protecting the nesting habitats and females as well as regulating the commercial fisheries in some manner.

The Audubon Institute will not endorse or support any program that would eliminate the use of turtle excluder devices simply because captive propagation programs might produce tens of thousands of offspring to be released into the environment or, in other words, trading turtles for TEDs.

Captive propagation is not the end-all answer to the endangered species problem, nor is captive propagation a substitute for addressing the factors responsible for a species decline such as habitat and population destruction.

Captive propagation, however, does play an indisputably important role in the overall conservation picture and needs to be considered on a species-by-species basis, taking into consideration the level of endangerment, the potential benefits and risks, and the status of the animal's natural habitat and population, and their potential for recovery. Captive breeding programs are about preserving options.

Use of captive propagation to assist in the recovery of endangered species is a valid conservation technique and can be used in a variety of ways to ultimately assist in the avoidance of species, subspecies, and population extinction. Non-endangered or less endangered species can be used as surrogates for recovery-oriented scientific research including developing propagation methods, new technologies, or other benefits to the endangered species in question.

Captive propagation can allow for the manipulation of gene pools to enhance genetic vigor, diversity, bloodlines, or produce a more appropriate age or sex ratio. Captive propagation programs can also provide refugia populations until habitat loss or damage is replaced or reclaimed or when environmental conditions improve.

Captive propagation can also provide new individuals for the establishing of new self-sustaining populations or supplement or enhance existing populations or provide individuals to fill life cycle gaps, all of which can be necessary for the recovery of the species.

In the same way, captive propagation programs can potentially be used in the recovery of the Kemp's ridley sea turtle by conducting additional basic research on the breeding and reproductive physiology of this species or by using less endangered surrogate species and by expanding and properly tracking captive stocks of Kemp's ridley sea turtles, thus providing larger refugia populations in large enough numbers and diverse enough lineages to act as an

insurance policy against some catastrophic event which might cause extinction of the wild population and to maintain genetic diversity and vigor.

The Freeport-McMoRan Audubon Species Survival Center would probably not be the best location for any large-scale breeding program of sea turtles or other primarily aquatic species due to the extreme high cost of building inland artificial sea water closed-system. And current plans only call for the breeding of select terrestrial animals, and there are no current plans for any research or breeding of any primarily aquatic species at this time.

On the other hand, the Audubon Institute has always been receptive and responsive to the needs of our Federal, State, and local governments as well as our colleagues in academia for assistance with animal or research areas in which we have expertise. For example, the National Marine Fisheries Service requested in 1992 that the Aquarium of the Americas take over the Sea Turtle Stranding and Salvage Network coordination for the State of Louisiana.

Consequently, if asked to do so and if sufficient funding were provided, the Audubon Institute would be receptive to developing captive breeding research programs including developing scientifically derived husbandry techniques and animal health protocols of captive stock, basic reproductive physiological research, and research into the technology of cryopreservation of genetic material to aid in the recovery of any aquatic species including sea turtles. Thank you.

[Statement of Mr. Choromanski can be found at the end of the hearing.]

Ms. FURSE. Thank you. I would like to go next to Dr. Derrickson.

**STATEMENT OF DR. SCOTT R. DERRICKSON, DEPUTY ASSOCIATE DIRECTOR FOR CONSERVATION, NATIONAL ZOOLOGICAL PARK, FRONT ROYAL, VIRGINIA**

Mr. DERRICKSON. Thank you. While recovery of some endangered species will undoubtedly depend on propagation programs aimed at the interactive management of wild and captive populations, there are critical questions as to when captive breeding is appropriate and the degree to which captive breeding should be emphasized relative to other conservation approaches.

In a recent paper on science, Tear et al. (1993) noted that 64 percent of all approved recovery plans in the United States called for captive breeding. Why so many? I believe there are two basic reasons. First, following the widespread use of game species' reintroductions during the 1940's and 1950's that were quite successful, the U.S. Fish and Wildlife Service and its fledgling endangered species research program adopted a strategy calling for both field and captive research and captive breeding to augment wild populations.

A second reason is that by the time most species are listed as threatened or endangered under the Endangered Species Act, wild populations are very small and under high risk. Captive populations are therefore being advocated by recovery teams to minimize the risk of extinction under severe and dire circumstances.

As you have heard from other speakers preceding me, there are a number of advantages of captive breeding. First, when wild populations are small and fragmented, captive populations can provide a safety net minimizing the probability of extinction while preserving genetic variation. Second, if captive breeding can be achieved and sustained, captive populations can provide animals for augmenting and reestablishing wild populations.

Third, captive populations can facilitate research on behavioral, physiological, and ecological characteristics that are difficult or impossible to address in the wild. And, finally, captive populations and their associated reintroduction programs can provide a foundation for establishing subsidiary programs aimed at habitat preservation, public education, and conservation training.

Captive breeding, however, does have some inherent disadvantages and problems, and some of these are quite significant. One of these is getting consistent reproduction in the captive animals. Because a wide variety of vertebrate species have been bred in captivity, it is frequently assumed that we can breed everything. In reality, however, only a relatively small percentage of described vertebrate taxa have been bred in captivity, and endangered and threatened taxa make up an even smaller percentage of this total. Furthermore, obtaining consistent reproduction and survivorship under captive conditions has proven extremely difficult in many cases, and experience has shown wide variation among taxa in their potential for captive breeding.

The probability of successfully establishing a self-sustaining captive population for any taxa is potentially much greater when (1), large numbers of founder animals are available simultaneously; (2), breeding biology and ecology of the species are well known; and, (3), the captive requirements of the species or a closely related species has been previously determined.

Because all of these conditions are rarely met when working with endangered species, there will generally be a lag time between a program's initiation and the development of a self-sustaining population and/or the production of surplus individuals for augmenting or establishing wild populations.

The duration of this lag time for any species is difficult to predict, since it depends largely on the biological characteristics and requirements of the species, the actual problems encountered in propagating the species, and the subsequent development of effective solutions to those problems.

The time lag in California condors, red wolves, and for the second captive breeding attempt of black-footed ferrets was relatively short—less than 10 years. Whooping cranes, Puerto Rican parrots, and programs for the Hawaiian crow still have not produced self-sustaining populations after over 20 years of captive breeding.

Another significant problem has to do with genetic and behavioral changes in captivity. In order to preserve extant genetic variation, conservation-oriented breeding programs must attempt to minimize change. Unfortunately, domestication is inevitable in longer term programs. Similarly, learned behavioral traits are also prone to rapid loss and modification in captivity, and these losses are apparent, especially when you return captive-bred animals to

the wild. And, in fact, most reintroductions to date of captive-bred animals have had very poor results.

Another problem in captivity is disease. It is often assumed that captive populations are safe compared to their wild counterparts, but this is simply a misconception, and captive individuals face mortality risks just like their wild counterparts although the risks are usually very different. A number of captive populations have had severe and significant disease outbreaks. And the apparent susceptibility of endangered species to disease argues for extreme caution in both establishing captive breeding programs and also in returning captive-bred animals to the wild.

Another problem has to do with physical and financial requirements. These can be quite substantial. Many captive breeding programs currently are running between $200,000 and $500,000 per year. When you sum this over the life of the program, these funds could do a lot in terms of preserving and restoring habitat.

Despite the gravity of problems considered so far, one of the most serious impediments to success in long-term captive breeding lies in the failures of administrative continuity and commitment. In my own limited experience in the past two decades with endangered species conservation, I have witnessed serious periodic deteriorations in the quality and commitment to programs for several endangered birds.

Personnel involved in these programs have necessarily changed over time, and funding has waxed and waned without regard to programmatic requirements. I know of no reliable mechanism to ensure the continuity of efforts, and this same problem, of course, afflicts all human endeavors and institutions.

Most importantly, captive breeding can sometimes detract or preempt better techniques. Captive breeding can divert attention from the real problems causing a species' decline and, in fact, can become a "technological fix" that merely prolongs these problems and does little to rectify them.

Finally, one of the most limiting factors of captive breeding is that it has a single species focus. When one considers the current estimates are that we are going to lose between 25 and 50 percent of the species diversity that exists right now over the next 50 years, single species recovery efforts are really limited in scope and probably limited in value.

In summary, I would like to state that I tend to agree with Bill Conway of the New York Zoological Society who has stated that, "In the preservation of biological diversity, the use of technology is a last resort." Certainly captive propagation must be considered a last resort. Thank you.

[Statement of Mr. Derrickson can be found at the end of the hearing.]

Ms. FURSE. Well, I would like to thank the panel for that terrific testimony. I am going to reserve my right to questions until Dr. Matlock returns. I have some questions for him. Are there any questions? Mr. Tauzin has questions.

Mr. TAUZIN. I thank the Chairlady. First of all, let me make note that the record contains the testimony of James R. Wood, Ph.D., Managing Director of the Cayman Turtle Farm, Limited. I would

like for purposes of the hearing to read into the record several excerpts from that testimony.

An excerpt on page two of his testimony regarding the issue of captive breeding of Kemp's ridley hatchlings—"Considering the extremely endangered status of this species, this number of hatchlings"—he is referring to an average of 2,300 hatchlings per breeding herd of 100 male and 100 female Kemp's ridleys—"if used to their full potential could have a significant impact upon the number of adult Kemp's ridleys in the wild." His statement on page three that headstarting is controversial—"Much of the controversy stems from the criteria used to evaluate the success or failure of headstart programs."

His statement on the bottom of the page—"There are several possible reasons for the failure to demonstrate that headstarting works. Many of the animals released in the past have had inadequate tags which remain on the animals for only a short time making it impossible to identify the animals at a later date. This problem becomes more severe when one considers that it takes 20 to 30 years for a turtle to become sexually mature in the wild."

His statement that, "It is true that the majority of mortality will occur within the first 12 months," and his discussion that the release of older animals or superheadstarting has been discussed but never undertaken on any significant scale. His discussion indicating that if yearlings were raised for an additional 6 years with an assumed additional mortality of 10 percent that there could be available for release 600 adults or some adult males or females from an initial yield of a thousand for a total cost of about $150 to $200 each. And if 10 percent of those 300 females became part of the nesting population, this would be a significant benefit to this population.

His statement also of great interest that the current cost of a Kemp's ridley hatchling is approximately only $10 at the Cayman Turtle Farms. Madam Chairman—I suppose a totality of the testimony indicating that the unfortunate demise of the Galveston program before turtles released under that program could obtain sexual maturity and actually begin to nest is rather well-amplified in his discussion.

Ms. Allen, you make the point in your testimony that how can you terminate a program on the basis that nesting has not yet occurred, when the program has not lasted long enough for the released turtles to reach sexual maturity? It seems to me that the folks who wanted to end this program found a rather strange reason to do it. When they said, "The reason we are going to do it is because the turtles are not sexually mature enough to nest," when by their very nature they are not going to be sexually mature at least for 8 years, perhaps 10 or 12 years, in the scientific data, is that what you are telling us in your testimony today?

Ms. ALLEN. Yes. I am saying that the decision—that is one of the reasons that I am here to say that very thing, that most of the turtles until 1985 that were hatched out when the eggs were brought up from Mexico were determined to be male. And at that time, then the correction was made so that there was at least equal male-female——

Mr. TAUZIN. When did that correction occur?

Ms. ALLEN. 1985—from 1985 on. Then that correction was made so the turtles who are out there resulting from that change won't be 10 years old until next year, and we only have TEDs on——

Mr. TAUZIN. So here we have a situation where the——

Ms. ALLEN. I think another important issue in the determination of the success of that is the fact that we were not protecting turtles at all until 1990 in Texas waters. I mean, maybe the law came in in 1989 but——

Mr. TAUZIN. But to amplify your statement, in the first case, the complaint was that male turtles were not coming back to nest, and then later on the female turtles didn't come back to nest when they were not even sexually mature enough to come back and nest?

Ms. ALLEN. They are not old enough.

Mr. TAUZIN. And so the program is terminated on that kind of basis?

Ms. ALLEN. Well, if that was the only consideration—that is undoubtedly one of them. If that is one of the criteria, I don't agree with that. I think that the determination was made too soon.

Mr. TAUZIN. I, of course, agree with you. When I read the testimony from the Audubon Institute Aquarium of the Americas' position paper, there is a rather strong statement made. And I quote, "It is unforeseen catastrophic mortalities of unknown causes such as we experienced in Louisiana—such of these could quite possibly push this species into extinction in our lifetime, and the issue of captive propagation of this species at least in this arena of basic research into reproductive techniques needs to be reconsidered as well as prioritizing the maintenance of captive stocks as an insurance policy against potential catastrophic losses."

That phrase caught my attention. It is a notion that we are talking about an insurance policy. I hear from environmentalists that they have been opposed to captive breeding programs because they believe that those who are pushing it want to use it as the only means of species protection. I cannot argue that point. That is correct. No one should ever claim that it is the only tool to be used. None of you have said it is.

But the question I raise and the question raised in your testimony, and you are going to have to help me with pronunciations, Choromanski?

Mr. CHOROMANSKI. Choromanski.

Mr. TAUZIN. Choromanski—is that why not have this insurance policy? Why not do this basic research, have this program ongoing along with other survival techniques, habitat protections, all the other things set aside, all the things that can work, to ensure, in fact, that some natural catastrophe doesn't wipe it all out as almost occurred in a number of species where captive breeding has been the last resort? Why not have this work being done early?

In fact, Mr. Woody, you make the very strong statement that you don't believe this ought to happen except as a last resort. But in your testimony you point out that unfortunately this research is never done soon enough. Now, how are we going to get the research done soon enough on whether captive breeding can be effective as an additional tool or as a last resort tool if, in fact, you terminate programs before they have had a chance to examine the effectiveness? Would you please answer that, Mr. Woody?

Mr. WOODY. I will, Mr. Tauzin. I am going to ask you to clarify for me, if you would please—there are two things here. Headstarting is one thing, captive propagation is another. Now, as has been stated by you also, there was work done to develop captive propagation techniques for the Kemp's ridley in cooperation with the Republic of Mexico, the United States of America, and Cayman Islands. Those techniques were developed.

Now, yes, perhaps they did not go far enough. Production was quite low which is true of all turtle production so far. Survival has not been good compared to wild animals. So that part has been done. Now, Cayman also found maturity occurring at 5 to 7 years of age. Now, whether that happens in the wild, we don't know. I personally doubt it.

Mr. TAUZIN. I think I may have asked the wrong person. I think it was Mr. Derrickson who pointed this out. Let me turn to him and maybe see if I can get an answer to this. On page 11 of your testimony, you conclude captive propagation should only be used as a last resort, but on page 10, you make the point that, "Nevertheless, it may be apparent in other cases that alternative conservation methods are unavailable and that captive breeding may be necessary for long-term survival of the species. Unfortunately, studies are not begun until a species is all but lost."

So the question I raise is why terminate programs before they have had a chance to develop the full scientific data necessary to determine whether, in effect, a breeding and release program can be effective if you make the point that these studies are never done soon enough, that they are always used as a last resort and when we don't have enough information to know if they will work by that time?

Mr. DERRICKSON. Now, there should be a clarifying phrase in there, and that is field studies. In many cases, unfortunately, the basic information we need on population demography and biology is just totally unavailable, and you are faced with a very small wild population, and so your only alternative is to bring them in. That is what that statement means.

Mr. TAUZIN. Well, doesn't that statement mean that if you are going to use captive breeding and release even as a last resort as you propose, that you ought to be pursuing programs like headstart and others that examine scientifically the efficacy of that type of a relief if it does become necessary as a last resort?

Mr. DERRICKSON. I really believe that the only time those types of studies should be pursued is if they are part of an approved recovery plan, that has undergone peer review, and where those studies on captive animals or captive populations would be very tightly coupled with information that is needed on the wild population as well.

Mr. TAUZIN. What does all that mean? Are you saying yes and no, you ought not do early studies?

Mr. DERRICKSON. Well, I think in many cases, yes, you want to go ahead and do studies on captive animals that can supply valuable information for——

Mr. TAUZIN. Including field studies on release and survival and reproduction——

Mr. DERRICKSON. Exactly.

Mr. TAUZIN [continuing]. Capacities. Right?

Mr. DERRICKSON. Exactly.

Mr. TAUZIN. Well, how can anyone justify terminating what was started in Galveston before it even had a chance to prove itself one way or the other? That is what absolutely blows my mind. Here we are dealing with the most threatened species of turtle. We have a program initiated where we have invested a great deal of money. We have the cooperation of the Mexican Government in wanting to help us to continue it and see how well it works. We have the testimony of others in the field on Cayman to tell us that in their experience it can work and does work, and yet we terminate it before the females released in our program reach an age of sexual maturity to check to see whether nesting will occur and reproduction will occur.

We terminate it without finding the results when we already have the most threatened, most endangered turtle on the list in dire jeopardy of total elimination. And as Mr. Choromanski has pointed out, one natural catastrophe and they are all gone possibly. How can we justify terminating good scientific work before we get the answers from that work?

I just cannot understand that, and I cannot understand why agencies of our government, environmentalists, all of us who are interested in finding solutions to these things can't reach some agreement in these areas; why do we have to think this is some political war? I think we have to terminate this program because we don't want to dare yield any political arguments over whether captive breeding or captive propagation works or doesn't work. Why can't we at least get the scientific answers before we terminate a program that is designed to give us those answers? Does anybody want to answer that? Yes, sir.

Mr. SPEAR. I think the answer is is that the way this decision was made is very consistent with the policy that we are developing in conjunction with the National Marine Fisheries Service. The basic policy is that the best scientists in the world will gather together and review these recovery programs, develop plans for those recovery programs. Those plans then go out and get public comment as well as peer review from fellow scientists. In this case, there was the strong recommendation against continuing this program.

In other words, this was done by the scientists who can look at the specific example and the specific species and decide whether or not this has merit compared with all the other things going on, and in this case, the recommendation was no. So——

Mr. TAUZIN. Ms. Allen says that is not true, and I am looking at her testimony. It says that the plan definitely did not call for the termination of the program already started. It simply called for the decision not to extend into additional programs before we get the results from this one. Now, how do you argue that we had to terminate this one when that recovery plan never called for its termination?

Mr. SPEAR. I don't have the exact words in front of me on what the plan said, so I can't respond to that.

Mr. TAUZIN. I have a quote. Ms. Allen quotes it. "It discourages the proliferation of additional headstart programs." That is a quote.

It never said you had to terminate the one experiment that was going forward. So if your answer is that the reason why we terminated this one was because the plan recommended against it, the answer is the plan did not recommend against it. The plan simply recommended against the proliferation of additional headstart programs.

Mr. SPEAR. Like I say, I don't have the specific response, but all I can say is that this program was started when there was a fear that the Kemp's ridley turtle might be gone in a matter of years. By the time it was terminated, the numbers of Kemp's ridleys, due to both protection of the beaches and the imposition of TEDs, was starting on the upturn. In other words, there was a clear possibility that those additional 2,000 eggs staying at the site could produce more turtles for the wild because the populations were beginning to come back. There was an indication we were turning the corner. I think it is——

Mr. TAUZIN. But look. We have a number of things on record here. We have a quote from the recovery plan indicating that they were encouraging results of headstarting. We have additional studies, that Ms. Allen points to Dr. David Owens indicating that not only was it working but that the headstarted turtles comprised, I think, 13 percent of the population in the Gulf. Something good was happening.

The recommendation of the recovery plan was not to terminate this program. It had not yet reached an age where we could determine how successful it was going to be, and it gets terminated. It gets terminated—cut off at the end before it had a chance to really realize any kind of scientific evidence for us. And all you tell us is, well, there was a recovery plan in place so we didn't need it. The recovery plan didn't call for it to be terminated; in fact, mentioned encouraging results of headstarting and cites the needs for more educational programs, in fact.

The recovery plan did not call for the termination of this program. It got terminated before it could work, before it could give us answers. And I have yet to hear anyone give me a valid explanation as to why our agency of government decided to do that in the face of encouraging evidence that it just might work and that it was increasing the population of wild animals in the Gulf. Anybody want to try? Mr. Woody, please.

Mr. WOODY. If I might make a stab at it, I would like to make some clarification here on what the document says, what Ms. Allen has said, and what you, sir, have said. This discussion and these points that encouraging results have been reported—now, what that talks to, that is out of context. Encouraging results have been reported for number 1 above. Now, number 1 above in the recovery plan—what we are talking to here is a blue ribbon panel of scientists that did an evaluation of the headstart program, its weaknesses and its strengths.

"Number 1 is growth and survival of headstarted turtles in the wild must be established." That is where some encouraging results have been reported. Now, number 2, which is a criteria, "Nesting of headstarted turtles must be documented. Nesting of sufficient headstarted turtles to contribute to maintenance and recovery of the population must be demonstrated."

Mr. TAUZIN. How can you do that if you terminate the program before the turtles are old enough?

Mr. WOODY. We put out over 20,000 turtles or something. Now, this is called an experiment. What I call it is very poor science, and I am partially responsible for it, and I will take that blame. But what we have done here is "out of sight, out of mind." We raise turtles in buckets, right or wrong, for nine months, take them out and dump them offshore in the Gulf of Mexico, and then we go back and start over again. There is no follow-up to this experiment. This is not an experiment, this is a joke.

Mr. TAUZIN. Mr. Woody, the blue ribbon panel you referred to recommended that the program be continued for 10 years following the installation of turtle excluder devices. The National Research Council—the Committee recommended headstarting be maintained as a research tool. Somebody obviously disagreed with you and the others who terminated this program, and it happens to be blue ribbon panels and national research councils disagreeing with you.

My point, sir, is that at the worst we have disagreement in the scientific community—at the worst. At best, we have a good deal of evidence that it ought to be continued for at least 10 years while the other conservation programs are at work. At best, we have evidence from independent studies that turtle populations are, in fact, affected dramatically by the headstart release turtles—13 percent according to the study Ms. Allen produced for us.

At best, we have information that these turtles released under headstart had not reached sexual maturity before the program is terminated. For all those reasons, it is extraordinary to me that somebody's prejudice intervened here, and a good program was shut down. I have no further questions, Madam Chair.

Ms. FURSE. Thank you, Mr. Tauzin. Mr. Tauzin, I have a time constraint. I am going to ask some questions of Dr. Matlock. Would you like to have time to come back in on that? Thank you. I have a couple of questions, one on the turtles which is not directed to Dr. Matlock but to everyone. The people on this panel who do want to terminate the program, could you tell me what other methods you would recommend to do what the program was supposed to do or what you had hoped the program would do? Anyone? Mr. Woody.

Mr. WOODY. Thank you. I have stated this for the record—my paper that I put in to the panel. But the main thing that has to be done above all else for this particular species, as I said, is to maintain the presence of the United States-Mexican contingent on that one nesting beach. Without that, we are in bad shape. The species will probably be lost.

That alone will not work though. We must also have and ensure we have the use of TEDs in both the United States and the Mexican shrimp fleets. These are the two most important items we could ever do. There are many other things that could be done, but these are priorities. If you said, you know, "I have got one dollar. What do you want to spend it on for the Kemp's ridley?" that would be it.

Now, if you said, "I have got two dollars, and it takes a dollar to do these things, what are we going to do with that other dollar?" then we can get into a lot of other things that would contribute to

our knowledge and understanding of the species and hopefully the better management and the full recovery of that species.

But we have to address the real threats that are facing us. Could there be a catastrophe in this species? If a catastrophe occurs, it would probably be on that nesting beach where we have the congregation of the adults for a period of a few months each year. Otherwise, the species in all age classes are scattered along the whole Mexican and United States coast from Texas clear to Maine. Yes, there can always be a catastrophe. There can be for any species.

But those are the main things that have to be done. Yes, we want educational programs. Yes, those should continue in both countries, both nations, and I hope that with the initiation of NAFTA, I think we should see more of that. Ms. Allen's contributions through HEART to education in Mexico as well as the United States have been outstanding, and I compliment her for this. I am sorry she and I disagree on the headstart issue.

What should be done as far as headstart and all the effort and all the resources that have gone into its follow up? Now that the animals are out there, what is happening to them? Nobody is looking for them, and I am not sure there was a program initiated to begin looking for those animals now. The Fish and Wildlife Service does not have the resources to do this, and I don't know if NMFS does. We have gone halfway after 14 years of a program of raising turtles, right or wrong, throwing them into the ocean, and as I said, we have walked away from it. What has happened to those turtles? Do we keep doing it ad infinitum? What is going on?

Ms. FURSE. Thank you. Dr. Matlock, in your testimony, you did not orally talk about the Columbia River salmon, but I have an antennae out for Columbia River salmon—I saw in your written testimony you did—and I wanted to ask you just a couple of questions to do with that.

As a scientific matter, it is my understanding that salmon stray and colonize new habitats. Isn't it likely that the Mid-Columbia sockeye which return in numbers between 50,000 and 80,000 sometimes in the past strayed into the Snake River? Is that likely?

Mr. MATLOCK. Goodness. I don't know the answer to your question specifically. My guess is that that seems to be reasonable from a general perspective. If I might though specifically answer your question for the record when I return back to my agency?

Ms. FURSE. That would be fine.

Mr. MATLOCK. Thank you.

[The following was supplied by Mr. Matlock following the hearing:]

Yes, straying occurs to some degree in natural populations. Adults may also temporarily wander out of the migration corridor, and may or may not eventually home to the natal stream. However, it is not likely that Columbia River sockeye salmon (Wenatchee and Okanogan populations) have strayed into Redfish Lake, the spawning ground for Snake River sockeye salmon, which is over 700 river miles away from the Wenatchee and Okanogan river/lake systems in the Upper Columbia River.

A substantial number of strays that fail to home accurately by an enormous distance would be required to significantly affect the genetic composition of Snake River sockeye salmon. No evidence has been presented to indicate that Columbia river salmon stray any substantial distance up the Snake River.

Even if a few Columbia River sockeye salmon strayed and spawned with Snake River sockeye salmon in the past, genetic studies have shown that there are major

differences in protein electrophoresis between Redfish Lake sockeye salmon and Columbia sockeye salmon.

Ms. FURSE. Let me continue with my line of thought that they did probably stray, and that makes them relatives of today's existing stocks—in some way relatives. Now, the Endangered Species Act addresses the use of live propagation, transplantation and trapping as methods of recovery. What I would like to know is on a scientific basis and a legal basis why is NMFS preventing the use of Mid-Columbia sockeye as a broodstock for the Snake River?

It is fine if you get back to me with these answers, but this is an issue that I don't often have an opportunity to ask you about, and it is important to me to see this in a large Endangered Species Act context. And if you could get back to me with those answers, I would be very appreciative, especially given the testimony today. This is very important to see in a larger context if I may, Dr. Matlock.

Mr. MATLOCK. I appreciate very much your understanding, and I will certainly do that with your concurrence. Thank you.

[The following was submitted following the hearing:]

NMFS has determined that it cannot use Columbia River sockeye salmon as broodstock for restoration of Snake River sockeye salmon because the two populations are genetically distinct, and they have different life histories. The Snake River sockeye salmon likely contains unique adaptive genetic characteristics because: (1) Redfish Lake supports the southernmost sockeye salmon population in the world; (2) sockeye salmon returning to Redfish Lake travel a greater distance from the sea (almost 900 miles) and to a higher elevation (6,500 feet) than do sockeye salmon anywhere else in the world; in contrast, sockeye salmon in the Wenatchee and Okanogan river/lake systems spawn at elevations more than 4,000 feet lower; and (3) upper Columbia River populations are in a different ecoregion domain (Humid Temperate Domain) than is Redfish Lake (Dry Domain).

If natural straying of Columbia River sockeye salmon occurs, and if these strays occasionally spawn with Snake River sockeye salmon, it does not occur at significant levels. Available information thus indicates that Redfish Lake sockeye salmon are reproductively isolated from other sockeye salmon populations, and there are several good reasons for considering them to be an evolutionarily important component of the biological species *Oncorhynchus nerka.* Based on these two criteria, Snake River sockeye salmon comprises an evolutionarily significant unit (ESU), and hence a distinct population, as described in NMFS' policy for application of the definition of "species" in evaluating Pacific salmon stocks (56 FR 58612, November 20, 1991). The ESA defines "species" to include "any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. Sec. 1532(16). Thus, Snake River sockeye salmon and Columbia River sockeye salmon, as separate distinct populations, are considered separate species.

To use Columbia River sockeye salmon as broodstock for restoration of Snake River sockeye salmon would not be appropriate from a legal nor a biological standpoint. From a legal standpoint, as stated above, Columbia River sockeye salmon are outside of the Snake River sockeye salmon ESU. NMFS' interim policy on artificial propagation of Pacific salmon under the ESA (58 FR 17573, April 5, 1993) discusses the role of artificial propagation in recovering a particular ESU and states that stock transfers should be considered only in extreme situations. The situation is not so extreme because residual sockeye salmon in Redfish Lake have been found to be part of the Snake River sockeye salmon ESU, thus providing a larger gene pool for the broodstock program. From a biological standpoint, using Columbia River sockeye salmon for broodstock purposes will risk losing the distinctive qualities that make Snake River sockeye salmon an ESU. In general, stock transfers have not succeeded with salmon, particularly for sockeye salmon.

Ms. FURSE. If there are no further questions of the witnesses and hearing none, I would like to thank you all for your tremendous testimony—not only your scientific knowledge but your interest in this most important subject, and the hearing is adjourned.

[Whereupon, at 11:13 a.m., the Subcommittee was adjourned, and the following was submitted for the record:]

**TESTIMONY OF**

**DR. GARY C. MATLOCK**
**DEPUTY REGIONAL DIRECTOR, SOUTHWEST REGION**
**NATIONAL MARINE FISHERIES SERVICE**
**NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION**
**U.S. DEPARTMENT OF COMMERCE**

**BEFORE THE**

**SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES**
**COMMITTEE ON MERCHANT MARINE AND FISHERIES**
**U.S. HOUSE OF REPRESENTATIVES**

**MARCH 1, 1994**

Mr. Chairman and Members of the Subcommittee:

I am Dr. Gary C. Matlock, Deputy Regional Director, Southwest Region, National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. I appreciate this opportunity to inform you of the Department's views on the use of captive propagation to assist in the recovery of species listed under the Endangered Species Act (ESA).

For more than a century, NMFS and its predecessors have been involved in captive propagation of marine species. The ESA recognizes that captive propagation may be a useful tool for the conservation and recovery of threatened and endangered species. However, the ESA emphasizes the need to conserve species in their natural habitat. NMFS supports captive propagation programs for some listed species, but only as a last resort for recovery purposes.

Currently, NMFS and the U.S. Fish and Wildlife Service (USFWS) are jointly developing a Cooperative Policy for Controlled Propagation of Species Listed Under the ESA to provide guidelines for the use of captive propagation for listed animals and plants. These policies are necessary because there are a number of genetic and ecological risks associated with captive propagation. These risks include: (1) decline or extinction of the wild population because of the removal of adults for broodstock; (2) domestication in captivity which may diminish ability to survive and reproduce in the wild after release; (3) disease transfer between captive and wild populations; (4) displacement of wild populations through increased competition for food, space, and mates with captively reared individuals; (5) inbreeding in captive and wild populations resulting from the enhancement of only a portion of the gene pool; (6) reduction in genetic variability of the wild population due to swamping of wild populations with captively reared individuals; and (7) erosion of genetic differences between populations.

It is not always clear, however, that captive propagation will facilitate conservation and recovery efforts under the ESA. For example, at this time, we do not know if sea turtles raised in captivity and released in the wild assist recovery efforts. For this reason, NMFS does not support the use of captive

propagation of endangered sea turtles. Our efforts with the Kemp's ridley sea turtle best illustrate this uncertainty.

From 1980 through 1988, the National Marine Fisheries Service collaborated with the Cayman Turtle Farm on a captive breeding program for the Kemp's ridley sea turtle. The goal of this program was to breed Kemp's ridleys in captivity and to establish a captive breeding population. The Cayman Turtle Farm had very limited success breeding Kemp's ridleys. For example, only 30 percent of the female Kemp's ridleys bred in captivity. These breeding females laid fewer clutches than their wild counterparts, fewer eggs per clutch, and most of the eggs were either infertile or did not develop fully during incubation (Wood and Wood, 1988). Also, there have been no published reports on the growth and survival of the hatchling Kemp's ridleys produced at the Cayman Turtle Farm. In addition, their ability to survive in the wild has not been determined. And most importantly, their reproductive potential is unknown. If captive bred sea turtles cannot reproduce in the wild, they will not contribute to the recovery of the species.

NMFS' Kemp's Ridley Headstart Program, an experiment designed to determine if it is possible to increase the numbers of this critically endangered species in the wild population, has had limited success. Phase I of the Headstart Program was conducted from 1978 until 1993. During Phase I, Kemp's ridley eggs or

hatchlings were taken from their natal beach at Rancho Nuevo, Mexico and reared in captivity for approximately nine months and then released in the Gulf of Mexico. The program produced useful information on sea turtle husbandry, behavior, and physiology. However, we cannot yet determine the effectiveness of this program because we do not know how successful headstart turtles have been in the wild.

In an effort to remove this uncertainty, we entered Phase II of the Kemp's Ridley Headstart Program in 1993. During Phase II, we will evaluate the success of the headstart experiment by measuring the survivorship and fecundity of the 16,500 headstart turtles that were released in the Gulf of Mexico between 1978 and 1993. This strategy was recommended by the most recent independent review of the headstart experiment (Eckert et al. 1992). The review panel determined that we already had released a sufficient number of juvenile Kemp's ridleys and recommended that we look for these turtles in marine habitats and at nesting beaches, rather than growing more turtles.

Headstart is not a proven conservation technique for the recovery of sea turtles and should not be viewed as such until we can determine the success of our headstart experiment. There is evidence that shows headstart turtles survive, grow, and use the same habitats where wild Kemp's ridleys occur. There is also evidence which raises concerns about their ability to adapt to

the wild. Headstart turtles suffer disproportionately high mortality during the first 12 months in the wild (Manzella et al. 1988); some also display maladaptive behavior that may be a consequence of their being raised in a protected environment during a critical phase of their development.

Aside from our experience with sea turtles, captive propagation programs affecting species protected by NMFS have been used to supplement runs of anadromous fishes for fisheries enhancement and mitigation -- especially salmon in the Pacific Northwest in the Snake River. By avoiding most of the high mortality that occurs in the early life stages, salmon hatcheries can produce more smolts to migrate out to sea. However, such programs may do little to increase natural spawning populations of salmon. Under some circumstances, hatchery programs may even have a negative effect on natural populations. At present, NMFS bases decisions concerning the use of captive propagation of threatened and endangered salmon on the Interim Policy on Artificial Propagation of Pacific Salmon, published in 1993 (Interim Policy on Artificial Propagation of Pacific Salmon, April 5, 1993). We intend to review this Interim Policy in the context of the joint policy we are developing with the USFWS, and discuss the issue further with Northwest Indian Tribes and other interested parties.

A good example of the importance NMFS places on using captive propagation only as a last resort for recovery purposes is the Snake River sockeye salmon captive broodstock program initiated when the run was down to four adults in 1991. This program involves the artificial spawning of adults, rearing of their progeny to maturity, spawning of the progeny, and releasing the progeny's offspring into the wild. The success of the program is yet to be determined since the first progeny of the captively reared sockeye salmon are expected to be released in 1995. Smolts will be marked with distinctive tags for future evaluation of success or failure of hatchery supplementation.

NMFS has also authorized captive propagation programs for threatened Snake River spring/summer chinook salmon, on a limited basis. We cautiously evaluate hatchery permit applications because some hatchery programs have contributed to the decline of wild Snake River spring/summer chinook salmon. Notwithstanding the captive propagation program, NMFS believes that effective recovery of listed Pacific Northwest salmon requires substantial changes to the primary activities that have caused the species' decline -- the Columbia River Basin hydropower system, watershed habitat management, and fish harvest.

Captive propagation programs have also been authorized by NMFS for the endangered population of Sacramento River winter-run



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chinook salmon. These are small experimental programs; results from the evaluation of their success will be available in a few years.

In summary, NMFS only supports the use of captive propagation to assist in the recovery efforts of listed species as a last resort, when identified by a recovery team of experts, if the genetic and ecological risks are minimized, if adequate monitoring is included, and other recovery actions that address the causes of a species decline are also implemented. Captive propagation must not be a substitute for solving difficult problems such as restoring habitats or reducing incidental take and mortality of listed species.

Thank you Mr. Chairman for the opportunity to testify on this important subject. I would be happy to answer any questions you or other members of the Subcommittee may have.

**STATEMENT OF MICHAEL SPEAR, ASSISTANT DIRECTOR, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, BEFORE THE MERCHANT MARINE AND FISHERIES COMMITTEE, SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES, CONCERNING THE PROPAGATION OF THREATENED AND ENDANGERED SPECIES**

**March 1, 1994**

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Mr. Chairman and members of the Subcommittee, I am pleased to be here today and to have this opportunity to share with you the Fish and Wildlife Service's (Service) views on propagation, and to report on the status of the joint Service/National Marine Fisheries Service interagency policy currently under consideration on propagation of species listed under the Endangered Species Act. This is an appropriate topic for interagency policy development since both Agencies are responsible for implementation of the ESA and both have significant interests in the use of propagation for recovery of listed species.

For the purpose of this testimony I would like to use the term "propagation" rather than "captive propagation." The term "captive propagation," while understood to generally mean the reproduction of species in captivity, does not adequately cover the scope of activities in which plants and animals may be manipulated in a manner to increase their numbers or to aid in the achievement of recovery goals.

Within the context of the interagency policy, the use of the term "propagation" allows both Services to address a wider array of techniques presently and potentially available to biologists for

use in the propagation of listed animals and plants. It allows the inclusion of techniques that do not necessarily require the captivity or temporary maintenance of the plants or animals being manipulated. Therefore, under the interagency policy, propagation will include the enhancement or suppression of fertility, mating, transfer of gametes or embryos, development of offspring, and grow-out of animals when intentionally confined or directly manipulated by humans in the wild. Propagation of plants, using seeds, spores, callus tissue, divisions, cuttings or other plant tissue under managed conditions is also included in this definition.

## BACKGROUND

As a resource management tool, propagation has been in use for decades. The Service has historically been the lead government agency for the development and implementation of propagation technologies for animals, in particular fresh water fish species. Today the Service is involved in the propagation of species representing most of the major groups of animals and plants.

Propagation can be a vital tool for aiding species recovery. Significant successes include the improving status of the peregrine falcon, red wolf, greenback cutthroat trout, black-footed ferret, California condor, and whooping crane. Among plants, propagation is assisting the recovery efforts for numerous species including the green pitcher plant, endangered cacti, and several of Hawaii's endangered native flora. For plants, propagation is especially

important because of its generally low cost in comparison to propagation of animals and the critically low numbers of individuals of many listed plant species.

## SUCCESS STORIES

In 1975, it was estimated that there were 60 pairs of peregrine falcons in the wild within the U.S. By 1991, that estimate had been revised upward to 700 pairs. The combined elimination of organochloride pesticides and a vigorous propagation and release program has brought this bird to the point where reclassification to threatened status is being considered.

In 1975, on the verge of extinction with only 14 animals in the wild, the last remaining red wolves were captured. Hybridization and other problems initially complicated the initiation of propagation for recovery. However, these issues were resolved and red wolves are being successfully bred in captivity and once again are breeding in the wild. Red wolf reintroductions have been successful at the Alligator River National Wildlife Refuge and Great Smokey Mountains National Park.

In 1937, it was thought that the greenback cutthroat trout might be extinct. However, two small populations were discovered in western Boulder County, Colorado. Recovery efforts, including propagation for this species, began in 1959 through a cooperative effort between Federal, Tribal, and State agencies. With the enactment of

the Endangered Species Act the fish was listed as endangered and a recovery team was established. Continued propagation and recovery progress is being made and has already resulted in downlisting the species from endangered to threatened status.

In 1986, after years of discussion, Federal and State officials agreed to place the last five California condors in captivity. The last wild bird was captured in 1987. Propagation programs were initiated at the Los Angeles Zoo and San Diego Wild Animal Park. In 1993 birds were released into the Sespe Refuge. Because of unexpected mortalities (ingestion of antifreeze and collisions with power lines killed three birds), survivors of the initial release were recaptured and released, along with additional birds, in safer habitat. The released birds are doing well at the new site and extinction of this massive and magnificent bird has been avoided.

These success stories, and others, like whooping cranes and Mississippi sandhill cranes, demonstrate that technology is available or can be developed that can help species, even those critically endangered, to recover. When we can produce species with sufficient genetic integrity, appropriate behaviors, environmental adaptability, and other necessary capacities, a return to prosperity in the wild is possible. As we are fond of saying in Interior, "endangered means there is still time."

**PROBLEMATIC AREAS**

It cannot be stressed too strongly that while propagation definitely has a supportive role in recovery of some species, it is not a substitute for recovery of listed species in the wild. The Endangered Species Act (ESA) clearly states that its intent is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Therefore, it has long been interpreted that the mandate of the Service is to recover wild populations in native habitats whenever possible.

I reference the intent of the ESA to conserve and restore habitat because another issue of concern to the Service is the notion that propagation can be used in a manner analogous to factory production, an "if you need more, make more" approach. The suggestion that species currently at the center of perceived resource-versus-economic controversies should be propagated and in essence "stockpiled," so that they are no longer at risk of extinction while the economic activity continues, is fundamentally inconsistent with good resource management and the intent of the ESA.

If the use of propagation is to reach its full potential for contributing to the recovery of listed species, it must be part of a clearly defined and ongoing recovery program that meets the needs of endangered and threatened species and the ecosystems upon which

they depend. Criteria by which species' recovery is judged are not based on numbers alone. In light of this, the need to address overall recovery needs for species being propagated is one of the central themes of the joint policy document.

The paradox over propagation as a recovery tool for listed species is that, while the Service and others have demonstrated the ability to successfully breed some species and use this technology to return them from the brink of extinction, propagation in and of itself is inappropriate unless these plants and animals can be returned/released to secure natural habitats where they may become self-sustaining, naturally reproducing components of their ecosystems as intended by the ESA.

At this point, I would like to share with the Subcommittee the major elements of the policy under consideration and its implications to the Service's propagation activities for listed species.

**THE POLICY**

Propagation of endangered and threatened animals and plants has increased markedly over recent years. As a tool, propagation is receiving increasing attention as a strategy for conservation and recovery of endangered species. At this time, the Service and Service cooperators (States, Tribes, and non-governmental organizations) are involved in the propagation or maintenance of

more than 200 species. Because of the anticipated expansion in recovery-oriented propagation, a policy providing guidance on this issue has been clearly needed.

Reasons for initiating propagation efforts include:

- avoiding species, subspecies, or population extinctions;

- maintaining genetic vigor, diversity, bloodlines, and an appropriate mix of sex ratios and population age structure;

- maintaining refugia populations when holding **nearly extinct** animals or plants until necessary habitat modifications are attained or environmental conditions improve;

- providing individuals for establishing new, self-sustaining populations necessary for recovery of the species, subspecies, or population;

- supplementing or enhancing extant populations, if necessary, to facilitate recovery of the species, subspecies, or population; and

- filling life-cycle gaps created by habitat perturbations.

The interagency policy currently under consideration identifies specific requirements that must be met prior to the implementation of propagation for purposes of plant or animal production for recovery. The major requirements being considered are:

- with limited exceptions such as emergency situations and research, propagation must be identified as a recovery action in a final approved recovery plan for the species;

- appropriate analyses and safeguards protecting the species must be met such as the development of genetic management plans and population viability analyses when appropriate;

- initiation of propagation for purposes of stocking, supplementing, or creating new populations must be approved by the Director of the responsible agency(ies);

- propagation for supplementation and reintroduction must be preceded by appropriate actions to secure adequate habitat; and

- there will be substantive, but reasonable reporting of activities, accomplishments, and expenditures on an annual basis to the Services' Directors.

Unless these fundamental conditions can be met, propagation would

not likely be sanctioned. In addition, when a decision to use propagation is made, the Service intends to be very clear as to how success will be measured, how long the effort will take, and to have established from the beginning a clear end point, whether due to success or failure, at which propagation efforts will be terminated.

The interagency policy on propagation being considered by the Fish and Wildlife Service and National Marine Fisheries Service would provide guidance and establish consistency between the Services in the implementation of these principles.

Thank you for your time and consideration. If there are any questions, I will be happy to address them.

# HEART
## (Help Endangered Animals-Ridley Turtles)

P. O. Box 681231
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Carole H. Allen, Chair, Houston

Albert H. Barr, Spring Independent School District
Sherron Barrow-Dressler, Spring Independent School District
Jane A. Allen, Spring Branch Independent School District
J. T. and Cathy Thomas, Galveston Independent School District
Carlos Hernandez, Spring
Dr. Calvin Blakley, Houston

*Purpose: To save the Kemp's ridley sea turtles from extinction through education of the public and support of conservation laws and programs.*

**Statement of Carole H. Allen**

**Founder of HEART (Help Endangered Animals-Ridley Turtles)**

**For**

**The Sub-Committee on the Environment and Natural Resources**

**U. S. House of Representatives**

**March 1, 1994**

Thank you for inviting me to appear before this committee to provide information about HEART (Help Endangered Animals-Ridley Turtles) and our work to prevent the extinction of the Kemp's ridley sea turtles. HEART is an all-volunteer, grass roots organization that started in 1982 after Houston elementary school children took a field trip to the Galveston Laboratory of the National Marine Fisheries Service (NMFS) to visit the headstart project for the Kemp's ridley sea turtles. HEART has raised public awareness about these sea turtles in Houston, along the Gulf Coast, and then throughout the rest of the country and internationally as well. Until last summer, when headstarting was suddenly stopped, we were an unpaid public relations firm telling about the good work of NMFS and the Fish and Wildlife Service (FWS).

I request that my comments and all the accompanying materials be placed in the official record of this hearing. I have included a number of documents to verify my statements for reference by the members of the committee.

HEART has raised over $100,000 for the headstart experiment and research, mostly through the donations of school children who bought the turtle chow for the hatchlings at Galveston for 12 years; built and gave a new turtle house to NMFS as well as equipment; bought an All Terrain Vehicle, a used truck, generators and other equipment for the turtle camp in Mexico; provided money for graduate research and projects by

Texas A&M University at Galveston and College Station, Texas; the University of Texas Medical Branch in Galveston and Marine Science Institute at Port Aransas, Texas, and co-sponsored the international Kemp's ridley symposium in 1988. We also loaned an electronic balance and PA system to the NMFS Laboratory. The Valentine Sea Turtle Open House we co-sponsored with NMFS for many years brought thousands of people to see the sea turtles. The Mayor of Galveston proclaimed an annual sea turtle conservation day, and hundreds of students, members of science clubs, and Boy and Girl Scouts have assisted over the years. HEART also sends educational brochures, videos and posters to teachers, students and the inquiring public.

We have focused attention and gained supported for the Kemp's ridley sea turtle conservation program through articles in the Exxon Company's publications, *Ranger Rick's Nature Magazine* by the National Wildlife Federation, Reader's Digest's *New Choices*, *Texas Monthly,* the *Audubon*, *Outdoor Retailer Source Book*, *More Free Stuff For Kids*, *Marine Turtle Newsletter*, Pamela Phillips' book, *the Great Ridley Rescue*, and countless other publications.

I do not pretend to be a marine biologist or a scientist, but I read the research documents, government reports and proceedings of official seminars that pertain to sea turtle conservation and especially the Kemp's ridleys. I represent a grass-roots, all-volunteer organization of ordinary people who believe they can make a difference and who also believe that the future of our country including its environment and natural resources depends on the children now in our school systems.

Before I discuss HEART's objection to the termination of headstarting last summer, I want to be clearly understood about the subject of Turtle Excluder Devices (TEDs). HEART members across the country wrote thousands of letters to members of

Congress in 1988 to defeat a House Bill to delay the use of TEDs in shrimp nets. I think the Honorable Chairman of this committee may remember that. We believe that TEDs are absolutely necessary for the survival of all sea turtle species. The study done by the National Research Council at the request of Congress and the shrimp industry recommended the use of TEDs as well as other important conservation measures. Although shrimpers still occasionally make news when they are cited for shrimping without TEDs or for sewing their TEDs shut, compliance seems to be improving and we believe that many fishermen have accepted the law and are working on other issues--competing with imports and reducing fish bycatch. (Sports fishermen in Texas have recently announced a plan to buy out bay shrimpers to protect the integrity of the bays by stopping shrimping there. *Houston Chronicle, 2-3-94*) The recommendation about headstarting in the executive summary of the National Research Council report is short and to the point and we support it: **"Headstarting should be maintained as a research tool, but it cannot substitute for other essential conservation measures."** (Decline of the Sea Turtles. Causes and Prevention. 1990, p. 14) HEART agrees with it.

Dr. Peter Pritchard, a sea turtle biologist who is well-known and respected internationally, believes that there are fewer Kemp's ridley than we thought previously. (Marine Turtle Newsletter, No. 49, 1990) He has calculated that there may be less than 400 females nesting each season at Rancho Nuevo in Mexico but there used to be 40,000 in a single day in 1947. FWS places whooping crane eggs in Sandhill crane nests, puts toy puffins on cliffs and uses condor puppets to feed condor hatchlings. Why? Because those birds are in danger of becoming extinct. And so are the Kemp's ridley sea turtles. We must do everything possible to save them. Headstarting should be restarted even if it seems extraordinary and it's controversial.

Last July, Kemp's ridley hatchlings were ready to be moved to Galveston, Texas, from the nesting beach near Rancho Nuevo, Mexico, by the U. S. Coast Guard, for the headstart experiment. The Mexican government had issued its permits; the Coast Guard had cleared Mexcian air space; the Galveston Laboratory was ready and the public and the media were expecting the hatchlings. But they did not come. FWS refused to issue a final CITES import permit. A reporter with the Houston Chronicle broke the news to HEART. (See clipping) In 1985, Jack Woody, (formerly of FWS) cited the dependence of the entire operation on the cooperation of Mexico and said **"I see this program [which included headstarting] continuing, and the FWS will continue to provide assistance so long as Mexico wishes."** (Kemp's Ridley International Symposium, p.1-5, 1985) Last summer, the Mexican diplomats had done their work and the Mexican crew had worked hard to have the turtles ready to go when word came suddenly and rudely that there would be no transfer of hatchlings. Even Phil Williams, NMFS National Sea Turtle Coordinator, said "it caused embarrassment to both NMFS and to the Government of Mexico...." (Marine Turtle Newsletter, 1993) These turtles have been a gift from Mexico to the people of the United States every year, and last year, the United States turned Ithumbs down the gift of hatchlings. **They had represented a successful mini-NAFTA since 1978.**

Last summer after the denial of the CITES permit by FWS, we were advised there was a 45 day period when NMFS could appeal the FWS decision if they received new information. Representatives Jack Fields, Billy Tauzin and Solomon Ortiz requested an appeal. (See letter.) There was no appeal. HEART submitted new research findings by Dr. Andre Landry of Texas A&M University at Galveston from new netting studies showing that headstarted turtles make up 13 per cent of the wild population in north Texas coastal waters. (See letters and research.) In spite of this significant new information submitted to NMFS, there was no appeal.

**A memorandum written by Charles W. Dane of the Office of Scientific Authority on July 15 and a letter to NMFS Regional Director Andrew Kemmerer from I. T.**

Saito of the Branch of Permits on July 19 killed headstarting. Both documents are incredibly flawed - full of errors, incomplete information and incorrect assumptions. (See documents.) Even Representative Kika de la Garza's letter from the Director of the Fish and Wildlife Service provides only information to justify the decision of his agency; not all the facts that must be known. (See letters.) The letter omitted the very important fact that mostly male turtles were hatched at the National Sea Shore until 1985. The imprinting of hatchlings there was stopped by FWS in 1988, just three years after a hatching error was corrected so mostly female ridleys hatched. This happened two years before the TED law was in place giving more turtles a chance to survive. The Dane (FWS) memorandum states that "it is estimated that Kemp's ridley sea turtles become sexually mature between 12 and 20 years of age." How can FWS expect to see headstarted turtles nesting before they're old enough? The first year where mostly females for the headstart experiment were hatched was 1985 and anyone can quickly calculate that those turtles aren't old enough to nest yet.

And Dane's statement that the National Park Service (NPS) is "patrolling Texas beaches to document any nesting of adult turtles" is really stretching the truth. NPS has done a great job with volunteers and a few staff, but they can only patrol several miles of beach around the National Sea Shore. They aren't able to patrol every day due to budget and personnel constraints, and this year they're already looking for money because neither NMFS or FWS are funding their efforts. (See letter.) Of course, the Sea Turtle Stranding and Salvage Network that provided such valuable information for the National Research Council fell apart when NMFS cut its funding. NMFS continues to be heavily involved in the Marine Mammal Stranding Network, but the sea turtles have come up short again.

Since NMFS cut back support for the stranding network after the TED regulations went into effect, how do they know whether the decrease in strandings is really due to TEDs or the lack of adequate patrolling.

The Saito letter stated that the Kemp's Ridley Recovery Plan "recommends against headstarting." **But, it does not.** (Refer to letter.) Instead, the Plan only "discourages the proliferation of additional headstart experiments." And we agree with this. **It definitely does not say to end the experiment. The Plan states that "If the head-start program can be shown to contribute significantly to sea turtle population recovery, then it could be included in a revision of this plan."** Headstarting cannot possibly contribute signficantly to sea turtle population recovery if it is terminated. If the experiment doesn't work, shouldn't the United States be the first to announce it to the world? If second and third generations of Kemp's ridleys are successfully produced, shouldn't the United States set the standards and the criteria for the other countries? **The Recovery Plan also refers to "encouraging results of head starting" and cites the need for more educational programs.**

The Saito letter says the headstarting experiment was "unproductive. " The bibliography of impressive sea turtle research published by NOAA (Technical Memorandum NMFS-SEFC-280) demonstrates its scientific productivity.

The same letter also questions the survival rates of headstarted hatchlings as compared to wild hatchlings. The headstart project produces almost 100 per cent survival during their year in captivity. First year survival in wild hatchlings is much less.

The Saito letter suggestion of "behavioral and physiological damage" caused by headstarting is not supported by any research of which I'm aware. On the contrary,

headstarted turtles of many ages have been found in natural habitats in the Gulf and Atlantic along with the wild Kemp's ridleys. Obviously, they weren't behaviorally or physiologically damaged.

FWS delivered the *coup de grace* to headstarting arguing that it isn't listed as a "Recovery Task Priority" in the Kemp's Ridley Ridley Recovery Plan. (See Plan pages.) However, little attention is being paid to several actions that <u>are</u> listed in the Plan and aren't being carried out. "Maintaining sea turtle stranding and salvage network" is a Priority 3, but the network has been reduced to a hit-or-miss potluck system of reporting by volunteers. "Managing nesting beaches including Padre Island" is a Priority 2 but the Parks Service at the National Seashore is begging for money to continue its patrolling because both FWS and NMFS won't fund them. "Promote TED use in Mexico" is a Priority 1 but neither agency will fund a study near Yucatan, Mexico, under the direction of Dr. Jack Frazier who believes ridleys are being caught and drowned off the Campeche Bank. (See letter.) He wants to study the situation with an associate who will be able to work with local fisherman to implement TEDs. He has not received funding from NMFS and not even a reply from FWS. **Although headstarting is not listed as a "recovery task priority," tagging Kemp's ridleys on the United States East coast remains a priority although <u>not one of these turtles</u> have ever been seen in the waters of the Gulf.**

Please note a letter from Dr. David Owens, the Chair of the Kemp's Ridley Recovery Team, who states he would like to see headstarting resume. (See Owens letter.) Dr. Owens and a committee authored the Kemp's Ridley Recovery Plan. Obviously, Dr. Owens was outvoted by committee members biased against headstarting some of whom either work for FWS or depend on the agency for financial support.

At one time, U. S. government agencies responsible for the Kemp's ridley recovery were building a stock of Kemp's ridleys for captive breeding. Just when the Cayman Island Turtle Farm proved breeding was feasible, the government withdrew support and began releasing the breeders. There are still a dozen very valuable adult Kemp's ridleys at Sea World in San Antonio and some in the Cayman Islands, probably enough to provide at least 2,000 hatchlings each year for the headstart program without tapping the wild population. Is this a possibility or not? It may have been before most of the big turtles were released. Captive breeding should be restarted before all the adults in the breeding stock are gone.

In 1989, a Blue Ribbon Panel of biologists who have been involved in Kemp's ridley research or directly with headstarting recommended that the experiment continue ten years after TED compliance. (Marine Turtle Newsletter 1990) But this positive recommendation didn't satisfy the critics of headstarting. NMFS called in another panel of scientists who had NO hands-on experience with headstarting and little experience, if any, with Kemp's ridleys. When this second committee concluded that headstarting wasn't needed, their recommendation superseded the Blue Ribbon Panel's and the ax started to fall on headstarting long before the ten years was up. In fact, it was only three years.

A letter I received in December from a FWS Regional Director contains an interesting shift in the FWS position. FWS is now concerned with the **cumulative** effect of removing eggs and hatchlings from the Mexican beach and states that it may be detrimental to the species. (In spite of this FWS concern, 200 Kemp's ridley hatchlings were brought to Galveston last August not for headstarting but for "research" of some kind.) Information from FWS and NMFS establishes that less than 5 per cent of the total eggs and hatchlings at Rancho Nuevo have been removed for the headstart

experiment. (See data.) Scientists Crouse, Crowder and Castle concluded in 1987 that eggs and hatchlings are not nearly as valuable to sea turtle population recovery as large juveniles and adults. This is not to say that eggs do not have value, but removing less than 5 per cent of annual production of eggs or hatchlings has never been shown to be detrimental to sea turtle population at large.

FWS tells us they are confident that the Kemp's ridley is going to recover without the headstart experiment, without the research it provides; without the public support that it fosters; without the money HEART has been able to provide, although we realize our contribution was small. I wish we could be confident that the Kemp's ridley will survive if it is put on the "back burner," but we're not. Last spring, 100 juvenile Kemp's ridleys were found dead along the Louisiana coast in a week. FWS personnel admit that very little is known about the habitat of the juvenile turtles, but the turtles were there near Grand Isle.. Has NMFS certified any TEDs that will exclude the small turtles? In a shocking tragedy at Rancho Nuevo last summer, a dozen adult female ridleys swimming to the beach to lay their eggs were drowned by Mexican shrimpers. We have shrimpers tying TEDs shut in Texas waters. Somehow we don't share FWS' confidence about the recovery of this sea turtle.

NMFS raised the hatchlings in buckets and then released them 10 to 20 miles offshore when they could have been taken to bays and allowed to adapt and slowly work their way out. They released some ridleys in Copano Bay, Texas, in 1985 and shrimpers working there illegally drowned over 50 headstarted turtles. Bay releases were never tried again although it makes common sense that a bucket-to-bay transition would be easier for headstarted turtles. This can't be done, however, if illegal shrimping is allowed in shrimp sanctuaries. A program to condition the turtles for release into the

wild was developed by the Galveston Lab but used only for turtles destined for TED testing.

In 1986, the Audubon Wildlife Report published Jack Woody's review of the international Kemp's ridley program with its components of headstarting, captive breeding, and the effort "to establish a second nesting population to further safeguard the species." (See report.) **His recommendation is that "no reduction in the current protective efforts of the United States and Mexico can be allowed if the species is to have any chance at survival." He also wrote of productive benefits of the program such as "sound data and techniques on how to maintain and raise healthy ridleys in captivity, diagnose and treat various diseases and viruses..."**

**It has been disturbing to see the game plan for the headstarting program change on someone's whim. Headstarted turtles have to be super-turtles. If they don't have higher survival rates than wild ridleys, lay eggs in a shorter time and live up to every unrealistic expectation, someone is quick to say they're failures. I asked FWS if I could attend a meeting of the Kemp's Ridley Working Group last year just to see how decisions are made, but no one even answered my letter.**

Those who developed the international program to save the Kemp's ridley sea turtle from extinction should be commended; those who patrol the beaches through the hot summer months should be applauded. The Galveston staff of NMFS who keep the turtles clean and work in the humid turtle house in the hot summer months deserve medals. But we feel differently about some officials in FWS and NMFS who have never really given this program a chance and who stopped it by not providing adequate funding or making information public that shows its successes. Now they justify their decision to walk away by saying the experiment does not have biological value.

Headstarting has been criticized for being very expensive but HEART has never been able to find out what it actually costs to raise a turtle for 10 months. We paid a Freedom of Information (FOI) Act charge of $418 to the Department of Commerce to get the answer to that one question. (See letters.) When we asked for a clarification of the information they provided, the information was denied unless we made another FOI request and paid more money. An organization that has worked over 10 years to raise almost $100,000 to support the NMFS Galveston Lab can't even find out how much it costs to headstart a turtle! We believe there has always been plenty of money in this program to do it right. But we suspect that the money was not always spent on the headstart experiment. There was no excuse for NMFS to cut corners in 1991 to move endangered ridleys in a truck to a second-rate marine lab in Panama City, Florida, where they were incorrectly handled and many died. Needless to say, we were very disappointed and angry, too. We asked for explanations, but we received none.

The members of HEART- students, teachers, parents- can't make sense out of stopping a scientific experiment before conclusions are reached, stopping a program of goodwill between Mexico and the United States, stopping an experiment that receives national publicity and support and one that has piqued the curiosity of thousands of students of all ages. And we wonder why young people get cynical about government and why they won't vote and participate?

We have always known that headstarting isn't a proven conservation technique and that it truly is an experiment. We will never accept it as a trade-off for the use of TEDs either here and in Mexican waters. And we know that the Mexican beach must always be protected.

The heartbreak turtle and the headstart experiment have fallen victim to both inter- and intra-agency squabbling, bureaucratic power plays and opportunistic misuse of both HEART and federal funding. We come to this committee with a request. We expect both FWS and NMFS to follow the mandate of the Endangered Species Act and to do everything possible to prevent the extinction of the Kemp's ridley sea turtle even if some bureaucrats have personal biases against methods like headstarting. Since headstarting isn't listed as a Recovery Task Priority in the Recovery Plan, it's time the Plan was modified. The headstart experiment, operated on a limited basis, as it was in Galveston, will provide answers if it is given a chance. According to Phil Williams' account in the Marine Turtle Newsletter, NMFS would have continued headstarting had they been able to import the hatchlings.

We hope you will look at all the information HEART has provided you for this hearing, keeping in mind that there is tremendous public support by people across the country who have invested their tax money as well as charitable contributions to headstarting and deserve a lot more than the sudden, unjustified termination of the program last July.

Thank you.

TESTIMONY OF JACK B. WOODY, WILDLIFE BIOLOGIST, BEFORE THE SUB-COMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES, U.S. HOUSE OF REPRESENTATIVES, REGARDING CAPTIVE PROPAGATION OF ENDANGERED AND THREATENED SPECIES

March 1, 1994

Mr. Chairman, thank you for this opportunity to discuss the propagation of threatened or endangered species as a recovery technique. I understand the primary reason for my presence here today is to discuss propagation of the endangered Kemp's ridley sea turtle.

To begin with I'd like to clarify that propagation is the reproduction of animals held in a captive environment. For all practical purposes this has not been done with the Kemp's ridley except in a small program some years ago designed to develop propagation techniques should all other recovery efforts fail and it became necessary to try to maintain the species in captivity as a biological curiosity, another example of our failure to maintain our nation's and the world's biological diversity.

Ridley propagation experiments were undertaken during the period 1980 to 1986 in cooperation with Mexico, the USFWS and Cayman Turtle Farm. Briefly, mating and successful reproduction took place at 5 to 7 years of age, the number of eggs per clutch (Ave. 60) was much lower than in the wild population (Ave. 103,) and hatch rate was approximately 13% versus 70-80% in the wild population. Those that did hatch were weak and survival was minimal. Cayman turtle farm has over 20 years' experience in attempting to propagate sea turtles in captivity, primarily for commercial purposes, and they have been the most successful of any that have attempted such an endeavor worldwide. However, low egg production and poor survival have been the history of sea turtle propagation by Cayman, Surinam, Mexico, France and Japan.

Cayman cost estimates were, I believe, quite high, while the NMFS headstart animals were close to $160 each. As a comparison, each healthy hatchling released at the Rancho Nuevo nesting beach is less than one dollar and hatching rate approaches 80% Why in the world would we think we could or even try to improve on this? I fully believe that with TED's being used in both the US and Mexican fleets and the ongoing beach protection, we will see a slow, but sustained recovery in the number of Kemp's ridley. Without these two key actions we can then kiss this species goodbye.

Rather than throw significant dollars at turtle hatcheries, which will be an embarrassing disaster, or politically force continuation of the discredited headstart experiment, funds

should be directed to providing additional resources to the Rancho Nuevo beach protection effort, acquire in public ownership key U.S. sea turtle nesting beaches, and continue efforts to improve turtle and finfish excluders while addressing other remaining fisheries and endangered species conflicts. These conflicts can be solved without sacrificing the turtles or the involved fisheries.

What has taken place with Kemp's over a fourteen year period was an experimental program called "Headstart." This consisted of moving eggs or hatchlings from the nesting beach on the Mexican Gulf coast to Padre Island National Seashore (eggs), or in the case of hatchlings, directly to the National Marine Fisheries Service Laboratory in Galveston, Texas. These animals were held in small buckets for a period of 8 to 10 months and then released offshore into the Gulf of Mexico.

This experiment was initiated in 1977-78 among the Fish and Wildlife Service, National Park Service, NMFS and the Mexican Ministry of Fisheries (SEPESCA.) The purpose of the experiment was, over a 10 year period, to move approximately 2,000 Kemp's eggs from Mexico to Padre Island each year. The objective was to hatch these turtles at Padre, raise them at Galveston for 9 months and release them - hoping that some of these animals would survive and be fooled into thinking they were born at Padre Island and would then return there to nest years later. Although this experiment was to run 10 years, it continued for 11 and then NMFS, with an existing staff and facility in place to maintain small turtles, wanted to keep going even without Padre Island. It had built its own public support and even though the whole project lacked all basic experimental design it perpetuated itself for another three years before the Fish and Wildlife Service and others had the backbone to say, "Enough is enough," of this so-called experiment.

Sea turtles have an innate ability to return to the beach where they were hatched. It may be 30 years or longer since the animal has been anywhere near this location, yet when it matures and is ready to reproduce it returns to the beach of its birth and repeats the cycle for the survival of the species. How the animals locate the beach of their birth is a mystery. We refer to this homing ability as "imprinting" and believe it occurs during a short span of time just prior to and after hatching and returning into the sea.

Both captive propagation and headstarting would like to ignore the fact of imprinting for it immediately raises the question of where these animals will end up, even if they survive, when it's time to reproduce. Based upon the weakness of the Cayman hatched turtles and those experimental headstarted turtles which were maintained in small buckets for 7 to 9 months and then dumped overboard a number of miles at sea, I must, using common sense alone, question the survival of these human-

manipulated animals. We don't even know what the proper diet should be. Keeping an animal alive in captivity is not evidence the diet is appropriate to help the animal survive in the wild or that the critter will be able to seek and find alternative food supplies in the Gulf of Mexico once no kind soul shows up to throw him Purina turtle chow in his new giant bucket called the Gulf of Mexico. Remember, that's all this animal knows of life - a small bucket that once or twice a day a human appears and releases Purina pellets into its world. Fortunately or unfortunately, the ocean masks many things, some good, some bad, and I wonder what the odds are of ever knowing how well these captive-reared turtles survive. Again, common sense and just a small knowledge of animals tells us it ain't good. I'd hate to be given those odds for my own survival.

At least some effort should be directed to trying to find out what has happened to the 20,000 plus animals already headstarted and released. My previous testimony of September, 1990, before this Committee addressed the weaknesses of this so-called experimental "headstart" effort. I am not casting blame for this program for I share equal or more responsibility than anyone else in initiating it and allowing it, through my muted objections, to continue beyond the 10 year agreed to plan. I did not foresee it would be as popular with the public, which in turn helped to perpetuate this misleading effort rather than directing efforts to less obvious, but truly important recovery needs.

Captive propagation of fish, wildlife and plants, endangered or not, has a place in resource management, but we must remember what our objectives really are. It's far too easy for propagation to become an end unto itself. It's popular, appears to make good sense, animals in captivity can usually be viewed by the public and we are all led to believe that the propagation purpose is to return animals to the natural environment which is seldom successful. Sounds great, but what happened that would cause such a decline in a wild species that necessitated such costly and drastic last ditch measures as artificial propagation? If these factors have not been identified and corrected then, Mr. Chairman, we are kidding ourselves. We can raise ridleys, elephants, or condors until we're blue in the face and it will be absolutely meaningless to the species' survival in the wild.

Insofar as the survival and recovery of the Kemp's ridley is concerned, and I've stated this on previous appearances before this Committee, the key survival and recovery actions required are the continued protection of the Mexican nesting beach by Mexico with Fish and Wildlife support and 100% use of Turtle Excluder Devices (TEDS) by the U.S. and Mexican shrimp fleets. Without these key actions everything else will be a waste of time and money and further detract from the real problems.

Captive propagation of the Kemp's ridley, or any sea turtle species as a recovery action is a hoax and a smokescreen to evade the real problems these animals face in their fight for survival.

Too often over 35 years of my professional career have I seen politics dictate the construction of fish hatcheries with inadequate water supplies, and stocking of fish and wildlife species where their survival is known to be less than a few days. The sad part is that the people we are supposed to serve are being misled while we continue to degrade our land, inland waters and especially our ocean resources and naively assume we can solve this problem by propagating turtles, red snappers, snook or blue fin tuna and releasing them into a hostile world. An animal raised in a confined environment, be it a small bucket for Kemp's ridley, a paddock for black buck or a cage for tigers, is certainly not ready to compete in its natural habitat, physically or behaviorally.

Legislation which directs or encourages propagation as a recovery tool must be suspect, for such legislation is totally unnecessary for the Fish and Wildlife Service already has the authority and is engaged in a number of such efforts. Legislation to highlight such a technique would only serve to highlight and emphasize a single tool, often of questionable value, high cost, often caterinng to special interests while further detracting from the real problems of habitat degradation and loss which must be given priority above all else.

Thank you, Mr. Chairman for this opportunity to provide my comments on this important issue.

# The Role of Captive Propagation in the Recovery of Endangered Species: a Position Statement of the Audubon Institute

by

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## INTRODUCTION

The following is a position statement of The Audubon Institute, Inc. concerning the use of captive propagation to assist in the recovery of species listed under the Endangered Species Act (ESA), and the role that captive propagation should play in the conservation of species in general. Additionally, this position statement also addresses the posed question of using the Kemp's Ridley sea turtle (*Lepidochelys kempii*) as a case study in captive breeding programs, and the role of the Freeport-McMoRan Audubon Species Survival Center in efforts to conserve endangered species.

The Audubon Institute is a non-profit organization, located in New Orleans, Louisiana, whose mission is to cultivate an awareness and appreciation of the Earth's resources and to help conserve and enrich our natural world. The Audubon Institute joins with other groups to preserve endangered wildlife and promote research to advance conservation efforts. The Audubon Institute operates a wide variety of public facilities and parks including the Audubon Zoo, the Aquarium of the Americas, Audubon Park, Woldenberg Riverfront Park, the Freeport-McMoRan Species Survival Center (FMASSC), and is in the planning stages of building the Audubon Center for Research on Endangered Species (ACRES), and the Audubon Insectarium.

## CAPTIVE BREEDING

The primary goal of conservation is to preserve wildlife in its natural state whenever possible, and thus *captive breeding should not be viewed as a panacea for the endangered species problem.*

However, the threat of extinction for some species may be too great, causing direct human intervention to become necessary. Captive populations are established as an insurance policy against extinction until present threats can be reversed or controlled. Many species, such as the black-footed ferret and the California condor owe their existence solely to captive breeding programs.

The conservation role of professionally managed zoos and aquariums is multifaceted, however, they contribute in at least six ways by:

1. Providing a refuge for threatened and endangered species by maintaining genetically and demographically healthy populations as reservoirs of genetic material and as an insurance policy against extinction.
2. Propagating animals for reintroduction into areas where they have been extirpated, and by developing successful reintroduction techniques.

3. Conducting veterinary, nutritional, reproductive, behavioral and other research, both basic and applied, which increases our ability to manage and conserve both captive and wild populations.
4. Developing and testing technologies which can be applied to field conservation.
5. Educating the general public in an attempt to change attitudes and lifestyles so that they might make informed decisions concerning wildlife and the environment.
6. Providing direct or indirect support for *in situ* conservation programs which may or may not involve a captive breeding component.

***Species Survival Plans***

The Audubon Institute's two primary animal facilities, the Audubon Zoo and the Aquarium of the Americas, are both accredited institutions of the American Zoo and Aquarium Association or AZA (formerly the American Association of Zoological Parks and Aquariums or AAZPA), which is a non-profit organization representing 162 of North America's best zoological facilities. The AZA declared conservation as its highest priority in 1980, and member institutions have taken up the challenge of species survival. The cornerstone of AZA's conservation efforts have been with the Species Survival Plan (SSP). The SSP was established in 1981 to address the genetic and demographic problems that can occur in small populations over long periods of time. Each SSP, which is administered by a species coordinator and elected propagation group, allows a number of institutions to manage their animals cooperatively in the best interest of the species. Through the SSP program, member zoos and aquariums work together to maintain genetically and demographically viable populations of endangered or threatened species as a hedge against extinction. The ultimate goal of these programs is to reintroduce animals back into the wild when habitat and population conditions are favorable, and to reinforce natural populations, not replace them. The Audubon Institute continues to participate in a wide variety of SSP's as an integral part of its conservation programs.

***Maintaining Genetic Variation and Demographic Stability***

Genetic variation is critical to species survival and, in small populations, genetic variation can be lost very quickly. Random, uncontrolled breeding can very quickly deplete a populations genetic variability, reducing its ability to adapt to changing environmental conditions. Inbreeding in any population can produce inferior individuals with a lower chance of survival. Demographic stability is also important to the long-term survival of animal populations. Without sufficient numbers of breeding individuals in the appropriate sex ratio, a population may go extinct.

***Animal Husbandry Research***

Another priority of zoo and aquarium biologists is to ensure that the animals survive in captivity to reproduce. Unfortunately, little or nothing is known about the basic biology and captive care requirements of many species. As a result, zoos and aquariums support or conduct a variety of research projects in areas as diverse as physiology, nutrition, reproduction, behavior, genetics and veterinary medicine.

## PROBLEMS AND LIMITATIONS OF CAPTIVE BREEDING

***Limited Gene Pools and Lack of Technology***

Species such as the California condor and the black-footed ferret dropped to less than ten reproducing individuals in the wild before a captive breeding program was initiated. Although the early years of these recovery programs have met with considerable success, the extent of genetic variation that has no doubt been lost is unknown, and the probability for a long-term recovery is questionable, particularly in light of the habitat destruction.

Captive breeding is not always the preferred course of action for all endangered species, however, regardless of what type of recovery action is to be taken, it is critically important to identify those species which are in danger long before they fall to such low numbers. The sooner recovery efforts are initiated, the better a species' chance of survival. This is especially true for species for which little or nothing is known about keeping or breeding them in captivity. The successes with the California condor and the black-footed ferret were largely due to research and previous experience with two closely related, or surrogate, species, the Andean condor and the domestic ferret. This surrogate species approach to research on endangered species may be the best option we have for learning how to help an endangered species survive without depleting or jeopardizing the existing populations.

Captive propagation carries with it some inherent genetic and ecological risks which include: 1) potential removal of broodstock from the wild, resulting in decreased genetic variability in the wild populations, 2) catastrophic loss of the entire captive population due to human error, disease, equipment failure, etc., 3) inbreeding within the captive population resulting in decreased genetic variability, mutation, or only partial enhancement of the gene pool, 4) controlled environments could diminish a species' natural capacity to survive and reproduce in the wild. Additionally, the introduction of captive reared individuals into naturally occurring populations also carries genetic and ecological risks and

include: 1) genetic introgression which may diminish local adaptations of the natural population, 2) increased predation, competition for food, territory, mates, or other factors which might adversely affect the natural population and 3) disease transfer.

***Space Limitations***

The amount of space in zoos and aquariums is extremely limited and tough decisions have to be made regarding which species are chosen for conservation efforts. In fact, because of space limitations, it is estimated that no more than about 900 species of vertebrates could be maintained by the world's zoos in viable populations. The problem is even greater at aquariums and other aquatic facilities where there is a much greater capital, maintenance and energy cost associated with life-support systems and animal care. This capacity and capability must continue to grow because it is estimated that more than 2,000 vertebrates are going to require captive breeding in order to save them from extinction.

**THE AUDUBON INSTITUTE**

**The Freeport-McMoRan Species Survival Center**

The Freeport-McMoRan Species Survival Center (FMASSC) was conceived out of the need to work with viable populations of endangered animals in a setting that did not have the physical space limitations, nor the environmental distractions, of a normal zoo. It has been shown that typical zoological parks, although excellent public educational facilities, are not always the best location to conduct controlled propagation. The FMASSC is a part of a growing effort and joins close to a dozen other U.S. zoos which have established separate breeding facilities.

The FMASSC is located on 1,114 acre site on the southernmost tip of land in a bend of the Mississippi River, 8 miles southeast of the central business district of New Orleans. The FMASSC was developed in cooperation with other zoological facilities including the Greater Baton Rouge Zoo, the Alexandria Zoo, and the Louisiana Purchase Zoo, and is operated in cooperation with the U.S. Fish and Wildlife Service. Planned breeding will be in cooperation with the American Zoo and Aquarium Association (AZA; formerly the American Association of Zoological Parks and Aquariums or AAZPA) and the Captive Breeding Specialist Group of the International Union for the Conservation of Nature (IUCN).

Plans call for the breeding of a select group of primarily terrestrial animal species which were selected based on criteria established by zoo professionals and captive breeding specialists from around the country. The primary criteria used to choose species were the level of endangerment and the species' ability to adapt to Louisiana's unique climate.

Current Captive Propagation Programs at FMASSC

**Red wolf**
status: *Endangered*
- participating in the red wolf recovery program of the U.S. Fish and Wildlife Service (USFWS) and the Species Survival Plan (SSP) of the American Zoo and Aquarium Association (AZA).
- breeding for maintenance of captive population and for release.
- temporary holding of immature future breeders.

**Mexican Grey Wolf**
status: *Endangered*
- will begin participating in the Mexican grey wolf recovery program of the USFWS and the SSP of the AZA this year.
- breeding for maintenance of captive population and for release.

**Mississippi sandhill cranes**
status: *Endangered*
- currently in discussion with USFWS over the possibility of taking over a portion of their crane propagation and release program.
- would breed for release.

**Baird's tapir**
status: *Endangered*
- breeding for maintenance of captive population.

**Bongo antelope**
status: *declining*
- breeding for maintenance of captive population and research into surrogate parentage by eland.

**Louisiana black bear**
status: *Threatened*
- holding a young, orphaned and non-releasable bear.
- participating in a genetic study.

**Saddlebill stork**
status: *declining*
- attempting first successful captive propagation.

**Rhino hornbill**
status: *declining*
- breeding for maintenance of captive population.

**Milky stork**
status: *Endangered*
- breeding for maintenance of captive population.

**Abdim's stork** status: *declining*
- breeding for maintenance of captive population.

Future plans include breeding programs for the Sumatran tiger and the endangered Cuban crocodile. There are no current plans for breeding, housing or conducting research on any primarily aquatic species at this facility.

**The Audubon Center for Research on Endangered Species (ACRES)**

The Audubon Center for Research on Endangered Species (ACRES) is still in the planning stages and will be built as an adjunct to, and within the property boundaries of, the FMASSC. ACRES will be constructed with funding from the U.S. Fish and Wildlife Service and be operated by the Audubon Institute.

The focus of the research conducted will be on advanced technologies that can be applied to captive propagation of endangered species. Examples of some of these technologies that may be pursued at ACRES are artificial insemination, in vitro fertilization, embryo transfer, surrogate parents, cryopreservation of gametes and embryos. These techniques are just starting to be worked out on a few exotic species, and this scientific field is wide open for application to endangered species. There will also be a laboratory dedicated to the study of molecular genetics as it applies to the questions of taxonomy, hybridization, subspeciation, etc. of endangered species.

ACRES and the breeding facility of FMASSC will complement each other. A species undergoing research at ACRES could be housed at the FMASSC, and a species being propagated at the FMASSC could benefit by the application of techniques developed at ACRES to enhance productivity.

It is unknown at this time whether or not any of these new technology reproductive techniques are directly applicable to any species of reptile, including sea turtles.

**THE KEMP'S RIDLEY SEA TURTLE**

The Kemp's ridley sea turtle is indisputably the most endangered species of sea turtle in the world today. Less than fifty years ago, the Kemp's ridley was an abundant species in the Gulf of Mexico, with the population being able to generate a synchronized reproductive effort resulting in a mass nesting

emergence (*arribada*) of an estimated 40,000 females nesting in one day on the single and only known nesting beach in Rancho Nuevo, Mexico. Such aggregations could only have been produced by a very large adult population. The Kemp's ridley sea turtle has experienced one of the most dramatic and devastating declines in population numbers ever recorded for an animal. In 1968, the largest single *arribada* was estimated at 5,000 females, and between 1978 and 1991 a single *arribada* rarely reached 200 females. This latter number is less than one-half of one percent of the single day's nesting reported in 1947.

There are many historical and present day threats to the Kemp's ridley sea turtle which may have contributed to its rapid decline including direct and indirect exploitation by man. Historically, this primarily involved the direct exploitation of the animals and their eggs for food. In more modern times this threat has shifted to the sea where the growth of the trawling industry in the Gulf of Mexico is correlated with declining numbers of turtles. It is unfortunate that the nature of the beast, the fact that sea turtles are primarily marine creatures but must come ashore to lay their eggs, contributes to their demise by having two habitats that are being threatened.

The recovery plan for the Kemp's ridley sea turtle, produced jointly by the U.S Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS), lists four criteria for the downlisting of its endangered status to threatened status, of which one is to attain a population of at least 10,000 females nesting in a season. This seems like a reasonable criteria considering that 40,000 turtles nested in a single day in 1947. However, it is unrealistic to think that this number is attainable in the short term. Indeed, the Kemp's ridley recovery team members estimate that "*If all recovery tasks are completed, the population increases in accordance to projections and new limiting factors are not encountered, downlisting could be initiated in 2020.*" This 28 year estimate (the plan was drafted in 1992) takes into account the fact that the time it takes a Kemp's ridley to reach sexual maturity in the wild is unknown and has been estimated, based on data from the Loggerhead turtle, to range from 12 to 35 years. It is not the intent of this position paper to reopen the controversy associated with the termination of the NMFS Kemp's ridley head-start program, and indeed the scientific community is sharply divided on this issue as well. However, it is interesting to note that, if the time to maturity estimates are accurate, the head-start "experiment" was probably terminated before the female animals produced could return to any nesting beach.

Unfortunately, this species recovery plan does not include any form of captive propagation, even as low priority task, or even restricted to continuing basic reproductive research. And although "maintaining captive stocks" is included in the plan as a recovery task, it is given the lowest priority level. Considering that we recently experienced the largest known mass mortality of Kemp's ridley sea turtles occurred in Louisiana this past Summer, and all of these dead animals

were juveniles estimated to be 1 - 2 years old, these priorities might need to be reconsidered. Due to the highly autolyzed condition of these animals when they washed ashore, the definitive cause of this mass mortality will probably never be determined. However, regardless of whether this mortality was caused by man or by some natural phenomena, it is certain that a critically endangered population such as the Kemp's ridley cannot afford such a devastating loss of immature stock. It should also be noted that these animals were from the natural population and not a part of the release of the "head-start" turtles from the Galveston NMFS laboratory. It is unforeseen, catastrophic mortalities of unknown cause such as these that could quite possibly push this species into extinction in our lifetime, and the issue of captive propagation of this species, at least in the arena of basic research into reproduction techniques, needs to be reconsidered as well as reprioritizing the maintenance of captive stocks, as an insurance policy against potential catastrophic loss. Additionally, it is highly probable that existing captive stocks may not possess the genetic diversity or be comprised of the proper age and sex ratios to recover this species in the event of catastrophic loss.

This species recovery plan also affords the lowest priority to "*Maintaining the Sea Turtle Stranding and Salvage Network*". This is unfortunate because this network provides much valuable information concerning different ages of turtles, food habits, movement, sex ratios, etc. which is unavailable by our only other encounters with these animals, during their nesting emergence. It is also because of the existence of this network that the Aquarium of the Americas was able to report the mass strandings of juvenile Kemp's ridley this past Summer.

The Audubon Institute in no way endorses any type of captive propagation of sea turtles, or any endangered species, solely for mass production for release or reintroduction back into the environment without concomitant conservation programs involving habitat and population protection. These concomitant conservation programs would include, but are not limited to, protecting the nesting habitats and females, as well as regulating commercial fisheries in some manner. The Audubon Institute will not endorse or support any program that would eliminate the use of Turtle Excluder Devices (TED's) simply because captive propagation programs might produce tens of thousands of offspring to be released into the environment, or in other words "trading turtles for TED's". The issue is far more complex than that simple proposal. Even if "production facilities" for turtles were successful in overcoming all of the obstacles associated with captive propagation, including the questions of maintaining genetic vigor, diversity, bloodlines, sex and age ratios, it would still require twenty to thirty years with these slow-growing animals to reach maturity and a measurable population increase. These concomitant conservation programs involving habitat and population protection would need to remain in effect for this time period and beyond.

## CONCLUSION

Captive propagation is not the end-all answer to the endangered species problem, nor is captive propagation a substitute for addressing the factors responsible for a species decline, such as habitat and population destruction.

Captive propagation, however, does play an indisputably important role in the overall conservation picture and needs to be considered on a species by species basis, taking into consideration the level of endangerment, the potential benefits and risks, and the status of the animal's natural habitat and population and their potential for recovery.

Captive propagation is a logical endeavor if endangered animals are to be maintained and used for the education of the public and for valuable conservation research. In this regard, captive propagation plays a significant role in the zoo and aquarium arena by supplying captive bred animals for this purpose without having to take additional animals from the wild.

Captive breeding programs are about preserving options. There is no dispute that habitat preservation is crucial to species survival, but oversimplification of the issue has confused the public. The debate over captive propagation versus habitat protection should not be an "either-or" discussion. Both are valid conservation tools that must be used in conjunction with each other. Captive breeding has a definite role in the "big picture" of species recovery and conservation, but there has to be concurrent population and habitat protection.

The use of captive propagation to assist in the recovery of endangered species is a valid conservation technique and can be used in a variety ways to ultimately assist in the avoidance of species, subspecies, and population extinction. Non-endangered or less endangered (threatened) species can be used as surrogates for recovery oriented scientific research including, but not limited to, developing propagation methods, new technologies, or other benefits to the endangered species in question. Captive propagation can allow for the manipulation of gene pools to enhance genetic vigor, diversity, bloodlines and/or produce a more appropriate age or sex ratio. Captive propagation programs can also provide refugia populations until habitat loss or damage is replaced or reclaimed or when environmental conditions improve. Captive propagation can also provide new individuals for the establishing of new, self-sustaining populations, or supplement or enhance existing populations, or provide individuals to fill life-cycle gaps, all which can be necessary for the recovery of the species.

In the same way, captive propagation programs can be used in the recovery of the Kemp's ridley sea turtle by: 1) conducting additional basic research on the breeding and reproductive physiology of this species or by using less endangered surrogate species, 2) expanding and properly tracking captive stocks of the Kemp's ridley sea turtle thus providing larger refugia populations in large enough numbers and diverse enough lineages to act as an insurance policy against some catastrophic event which might cause extinction of the wild population, and to maintain genetic diversity and vigor.

Captive propagation has its place in the conservation of sea turtles. The Audubon Institute has been, and will continue to be, an active participant in this regard, and would be more than willing to participate in, or spearhead, scientifically meritorious research programs associated with captive breeding. Since we do have in-house expertise in the area of aquatic animal, and specifically sea turtle, husbandry, we would be particularly interested in helping to develop proper procedures to "*Ensure proper care of sea turtles in captivity*". Areas of concern in this regard, according to the USFWS and NMFS would include "*Develop standards for care and maintenance including diet, water quality, and tank size*", "*Develop manual for the treatment of disease and injuries*", and "*Establish catalog for all captive sea turtles to enhance utilization for research and education*". Although these are not specifically a formal part of the species recovery plan for the Kemp's ridley, they are included as a formal recovery task in the recovery plans for the Loggerhead, Atlantic Green and Leatherback sea turtles. Since the use of surrogate species in captive propagation research is a proven and accepted method, these studies might ultimately be beneficial to the Kemp's ridley. In fact, the zoo and aquarium community already has a sophisticated computer-based cataloging and inventory system in place world-wide known as the International Species Information System or ISIS, and sea turtles are regularly catalogued at zoological institutions utilizing this system. This could easily be expanded to include research or other facilities housing sea turtles.

The Freeport-McMoRan Audubon Species Survival Center (FMASSC) would probably not be the best location for any large-scale breeding program of sea turtles, or other primarily aquatic species, due to the extreme high cost of building inland artificial seawater closed-systems. The average cost of construction of a public aquarium is currently around $ 400 per square foot, with the technical, life-support and aquarium component usually running at $750 - $900 per square foot.

On the other hand, the Audubon Institute has always been receptive and responsive to the needs of our Federal, State and Local Governments, as well as our colleagues in academia, for assistance with animal or research areas in which we have expertise. For example, the National Marine Fisheries Service requested in 1992 that the Aquarium of the Americas take over the Sea Turtle

Stranding and Salvage Network (STSSN) coordination for the State of Louisiana. Consequently, if asked to do so, and if sufficient funding were provided, the Audubon Institute would be receptive to developing captive breeding research programs, including developing scientifically derived husbandry techniques and animal health protocols of captive stock, basic reproductive physiological research and research into the technology of cryopreservation of genetic material, to aid in the recovery of any aquatic species, including sea turtles.

On behalf of the Audubon Institute, I would like to thank the members of the Committee on Merchant Marine and Fisheries for providing us the opportunity to share our views on this critically important issue.

Respectfully submitted,

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# TESTIMONY ON THE USE

# OF CAPTIVE PROPAGATION TO ASSIST

# ENDANGERED SPECIES RECOVERY

BEFORE THE SUBCOMMITTEE ON ENVIRONMENT
AND NATURAL RESOURCES

MARCH 1, 1994

STATEMENT OF:

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Summary. -- The progressive declines in many wild animal populations have resulted in widespread calls for the establishment of captive breeding programs. Captive breeding is only one of many possible conservation strategies, however, and its potential contribution to the recovery of endangered species is limited by a variety of significant difficulties. Of special concern are problems in: (1) obtaining consistent reproduction in some species; (2) controlling diseases in confinement; (3) avoiding detrimental genetic and behavioral changes; (4) meeting long-term financial and logistical requirements; and (5) securing administrative continuity and commitment. Ideally, captive breeding's direct role in species preservation should be limited to short-term situations where alternative management options have proven ineffective, or can be significantly enhanced. Where practical alternatives exist, they are generally far preferable to captive breeding. The identification of limiting factors and practical management alternatives should be a priority for research, and should be accomplished before populations decline below minimal viable size.

## Introduction

Endangered species conservation is clearly best served in the long-term by methods associated with habitat, community, and ecosystem preservation and restoration. However, because the rapid decline and fragmentation of wild populations have often outpaced our ability to ensure their survival, there has been a corresponding increase in the application of interventionist techniques, such as translocation, artificial rearing/head-starting, captive breeding, reintroduction, embryo transfer, and cryopreservation (Conway 1988, Foose and Ballou 1988, Seal 1988). New technologies clearly need to be developed and applied to species conservation, but should not displace older, more conventional methods in circumstances where the latter are appropriate and can be applied effectively (Cade 1986, 1988). The proliferation of captive breeding and reintroduction programs for endangered and threatened species, in particular, has generated both debate among conservationists (cf. Cade 1988, Ousted 1988, Imboden 1989, Frazer 1992, Meffe 1992, Rahbek 1993), and the adoption of specific policy statements by some conservation organizations (e.g. IUCN 1987). It is presently estimated that as many as 25% to 50% of the world's species will become extinct over the next few decades (Lugo 1988). Just as the scale of pending extinctions is large, so are the stakes in selecting optimal conservation strategies to minimize the loss of biodiversity (Diamond and May 1988).

While the preservation of some endangered species will undoubtedly depend upon programs aimed at either long-term captive maintenance or the interactive management of wild and captive populations (Snyder et al. 1987, Foose and Ballou 1988), there are critical questions as to when captive breeding is appropriate, and the degree to which captive breeding should be emphasized relative to other conservation approaches (Derrickson and Snyder 1992, Frazer 1992, Meffe 1992). Overall resources for conservation are not infinite, and captive breeding programs are normally quite expensive and labor-intensive if they are to be done comprehensively and for the number of years that may be necessary to achieve success (Cade 1986, 1988, Conway 1988). Furthermore, there are enough other serious constraints that affect captive breeding programs, that it is well to be cautious in implementing this approach as a conservation panacea.

This paper reviews some of the advantages and disadvantages of captive breeding as they apply to the recovery of endangered species. Although there are a number of significant potential benefits of using captive breeding in conservation, some of the problems inherent in this approach have not received the attention that is warranted. Some of these problems are not obvious to those unfamiliar with the field. Some are susceptible to partial control with strenuous efforts. Still others are close to inevitable, and severely limit the long-term value of the technique. Captive breeding can be a valuable technique for species conservation in specific circumstances, but its values have often been exaggerated, sometimes to the detriment of other more promising approaches. Captive breeding is a preferred conservation method only under very specific conditions, and only in a short-term sense. Captive breeding should be used in endangered species conservation only when captive populations can substantially enhance recovery objectives, and when more preferable conservation options are not immediately available.

## The Problems with Captive Breeding as a Recovery Method

### *Difficulties in Obtaining Consistent Reproduction*

Because a wide variety of vertebrate species have been bred in captivity, and because of the wide publicity surrounding captive breeding and reintroduction programs, it is often assumed that self-sustaining captive populations for many endangered and threatened taxa can be readily and easily established. In reality, however, only a relatively small percentage of described vertebrate taxa have been bred in captivity (Conway 1986, 1988; Cohn 1988), and endangered and threatened taxa make up an even smaller percentage of this total. Furthermore, obtaining consistent reproduction and survivorship under captive conditions has often proven extremely difficult, and experience has shown wide variation among taxa in their potential for captive breeding.

At one extreme are species that are a so prolific that measures must be taken to control their reproduction (cf. Lindburg 1991, Lacy 1991). Many large ungulates and a number of primates, for example, perform so well under captive conditions, that reproduction is almost guaranteed if males are allowed access to females. At the other extreme are species that adapt poorly to captive conditions, and have been difficult to keep alive, let alone breed (e.g. the Kakapo (*Strigops babroptilus*) Merton and Empson 1989). In many taxa (e.g. various marine fishes, coral snakes, certain primates, certain felids, giant pandas (*Ailuropoda melanoleuca*), and many species of birds) consistent reproduction in captivity has proven elusive despite years of effort. Many breeding programs (see Wiese et al. 1993 and reports therein) for threatened species face significant husbandry and management problems, that will have to be resolved before self-sustaining populations can possibly be achieved. Propagation research has intensified during the past two decades largely in response to these problems (Conway 1988, Seal 1988). To date, failures to breed well in confinement can be traced to a variety of causes, including inbreeding depression (cf. Danielle and Murray 1986, Ralls and Ballou 1983), psychological, physiological, or environmental requirements that are lacking in the captive environment (cf. Eisenberg and Kleiman 1977, Milliam et. al. 1988), hand-rearing (cf. Myers et al. 1988), and behavioral compatibility (cf. Bluhm 1985, Yamamoto et al. 1989).

The probability of successfully establishing a self-sustaining captive population for any

taxa is potentially much greater when: (1) large numbers of founder animals are available simultaneously; (2) the breeding biology and ecology of the species are well known; and (3) the captive requirements of the species, or a closely-related species, have been previously determined. Because all of these conditions are rarely met when working with endangered species, there will generally be time lag between a program's initiation and the development of a self-sustaining population and/or the production of surplus individuals animals for either augmenting or establishing wild populations. The duration of this time lag for any species is difficult to predict, since it depend largely on the biological characteristics and requirements of the species, the actual problems encountered in propagating the species, and the subsequent development of effective solutions to those problems.

The time between taking California Condors (*Gymnogyps californianus*) into captivity and returning young birds to the wild required less than a decade, and the captive population is continuing to expand within the constraints imposed by the delayed maturity that characterizes the species. The rapid progress of this particular program can be attributed to the fact that all three of the aforementioned factors were met, including the prior development of successful propagation and husbandry techniques using the Andean Condor (*Vultur gryphus*) as a surrogate (Snyder and Snyder 1989). Similar rapid successes have been obtained for the Red Wolf (*Canus rufus*)(Phillips 1990), and the most recent propagation attempt for the Black-footed Ferret (*Mustela nigripes*)(Thorne and Oakleaf 1991), although in both species the size of the founding population was smaller that in the California Condor. In contrast, the captive-breeding program for the Whooping Crane (*Grus americana*) has spanned more than two decades, and the captive population still cannot be considered self-sustaining. Progress of this program has been hampered primarily by small population size. Contributing factors have included a small initial founding population, high chick and adult mortality, infertility, the need to modify breeding techniques developed using Sandhill Cranes (*Grus canadensis*), and the annual exportation of captive-produced eggs to support a failed reintroduction attempt. Although captive-raised Whooping Cranes are now being released into the wild in Florida, the captive population is still being periodically supplemented from eggs collected in the wild (Derrickson 1987, Lewis 1990). Similarly, the breeding program for the Puerto Rican Parrot (*Amazona vittata*) has been underway for some 20 years, yet has never achieved full viability even though the captive population now exceeds 50 birds achieved largely through the infusion of wild-origin young. Despite the efforts of a succession of capable biologists and aviculturists, and the application of propagation and husbandry procedures successfully used with other closely-related species, reproduction in captivity has rarely exceeded six fledglings per year, and the population is still not self-sustaining. Basic causes of poor reproduction have not been surely identified. Although fertility of eggs has been a chronic problem (Brock and White 1992), the extent to which low fertility may trace to behavioral or genetic limitations remains uncertain. Propagation efforts for the endangered Hawaiian Crow (*Corvus hawaiiensis*) have yielded similarly dismal results. In this case, the small founding population of 15 wild-caught birds was drawn from a small, remnant wild population over a period of some 27 years, and to date only 7 offspring have been produced from four pairings. Low reproduction has stemmed from a combination of factors, including high adult mortality, mate incompatibility, sexual mal-imprinting, and infertility possibly caused by inbreeding depression (National Research Council 1992).

Results obtained to date clearly indicate that the potential for breeding rare and endangered species varies widely between taxa. Consequently, every recommendation to establish a captive breeding program needs to be objectively peer-reviewed to evaluate the potential impacts on wild populations, extant knowledge of the species biology, overall program design, estimated costs and facility requirements, and linkage with ongoing recovery efforts for wild populations.

***Genetic and Behavioral Changes in Captivity***

In order to preserve extant genetic variation, conservation-oriented breeding programs must attempt to minimize the effects of inbreeding, genetic drift, and adaptation to captivity through the deliberate control of reproduction, population size, and population demography (Foose and Ballou 1988, Lacy 1989). This is a difficult task, however, considering the practical limitations of space and controlling reproduction, the dynamic nature of evolutionary forces in small populations, the types of genetic variation to be maintained, and the uncertain nature of selection in the captive environment (cf. Lande 1988, Simberloff 1988). Because genetic changes resulting from general adaptation to captivity are inevitable, progressive domestication represents a significant problem, especially for longer-term programs in species with shorter generation times (Spurway 1955, Franklin 1980, Frankham et al. 1986, Flesness and Cronquist-Jones 1987, Lyles and May 1987, Lande 1988). The characteristics that make an animal a successful captive, unfortunately, are not always the same as those that assure survival in the wild.

Learned behavioral traits are especially prone to modification to rapid loss or modification unless the captive environment is deliberately structured to provide the appropriate physical and social experience during critical developmental periods (Campbell 1980, Kleiman 1980, Lyles and May 1987). Such changes in behavior can adversely affect both reproduction in captivity and survival in the wild. For example, it has long been known that many animals are particularly vulnerable to predators following their release to the wild. Recent studies by Thaler (1986) on Hazel Grouse (*Bonasa bonasa*), Rock Ptarmigan (*Lagopus mutus helveticus*), and Rock Partridge (*Alectoris graeca*) demonstrated that normal antipredator behavior disappears in chicks at about 3 weeks of age, unless this behavior was reinforced by the parent female. Similarly, Vincent (1960) found that hatchery-reared Brook Trout (*Salvelinus frontinalis*) had less stamina, less fright response, and less tendency to avoid predators, and lower survival than wild individuals.

Recent attempts to reintroduce captive-bred animals to the wild have revealed a variety of behavioral deficiencies in addition to predator avoidance and physical conditioning. These deficiencies include foraging, interacting with conspecifics, selecting suitable habitat and roost sites, and moving and navigating in complex habitats, among others. Subtle differences such as these become extremely apparent when captive animals are moved from the benign captive environment to the wild. To improve survivorship, many reintroduction programs have tried, with varying degrees of success, to correct these behavioral deficiencies through specialized rearing and training procedures (Ellis et al. 1978, Temple 1978, Cade 1986, Derrickson and Carpenter 1987, May and Lyles 1987, Zwank and Wilson 1987, Zwank et al. 1988, Horwich 1989, Kleiman 1989, Miller et al. 1990a,b, Wiley et al. 1991).

Beck et al. (in press) recently reviewed 145 reintroduction attempts of captive-bred animals (mostly vertebrates), and found only 16 (11%) cases where a viable wild population was established (i.e., 500 individuals free of provisioning, or where a population viability analysis indicated that the population was self-sustaining). While additional numbers of these reintroduction may yet prove successful, a similar analysis suggests otherwise. Of 198 translocations and reintroductions of birds and mammals reviewed by Griffith et al. (1989), 75% of the translocations involving wild animals were successful, whereas only 38% of the reintroductions involving captive-bred animals were successful. These results strongly suggest that reestablishing wild populations from captive-bred animals will be extremely difficult, and for many species impossible.

***Problems in Controlling Disease in Captivity***

It is often assumed that captive populations are "safe" compared to their wild counterparts, but this is simply a misconception. Captive individuals face a variety of "mortality risks" just like their wild counterparts, although these are likely to be different. The risks from some factors, such as disease, actually may be increased in captive populations because individuals are less dispersed than in the wild. Furthermore, there is a growing body of evidence suggesting that endangered species are relatively susceptible to disease due to their reduced genetic diversity, resulting from small population size (O'Brien et al. 1985, Dein et al. 1986, Jones and Owadally 1988, O'Brien and Evermann 1988, Thorne and Williams 1988). In recent years, captive breeding programs for a number of endangered birds have suffered losses and sometimes severe setbacks due to disease. Specific examples include eastern equine encephalitis in Whooping Cranes at the Patuxent Wildlife Research Center (Dein et al. 1986), inclusion body disease in Red-crowned (*Grus japonensis*) and Hooded Cranes (*G. monacha*) at the International Crane Foundation (Docherty and Henning 1980, Docherty and Romaine 1983), a herpesvirus in Mauritius Pink Pigeons (*Columba mayeri*) at the Rio Grande Zoo (Snyder et al. 1985), parrot wasting disease in several large private collections (D. L. Graham, pers. comm.), a sporozoan infection in Tahitian Lories (*Vini peruviana*) at the San Diego Zoo (W. D. Toone, pers. comm.), sarcocystis in Thick-billed Parrots (*Rhynchopsitta pachyrhyncha*) at the Gladys Porter Zoo (D. Thompson, pers. comm.), an unidentified agent in Puerto Rican Plain Pigeons at Humacao (*Columba inornata wetmorei*) (R. Perez-Rivera, pers. comm.), avian tuberculosis in White-winged Wood Ducks (*Cairina moschata*) at Slimbridge (Kear 1986, Cromie et al. 1989), avian pox (Landolf and Kocan 1976) and atoxoplasmosis (Partington et al. 1989) in Bali Mynahs (*Leucopsar rothschildi*) at the National Zoo, and canine distemper several in several captive populations of Black-footed Ferrets (Carpenter et. al. 1976, Clark 1989). In the case of atoxoplasmosis in Bali Mynahs, the disease was unknown in this species until the outbreak in 1987. Retrospective analyses of preserved tissues have revealed the presence of this parasite in the collection dates back to at least 1978, and the sudden outbreak was apparently related to the resumption of breeding and the increased susceptibility of young birds. It is now realized that atoxoplasmosis is widespread in the captive population, and one of the major causes of mortality (Seibels 1993).

The apparent susceptibility of endangered species to disease argues for extreme caution both in establishing captive breeding programs, and in their operation. As noted by

Ashton and Cooper (1989), disease prevention in captive programs should focus on the exclusion of pathogens rather than on attempting to eliminate them once established. Establishing adequate quarantine procedures is made difficult, however, because reliable diagnostic tests and vaccines are presently unavailable for many pathogens. Especially worrisome is the fact that some diseases can remain latent for long periods, only to manifest themselves later when animals are stressed. Due to these difficulties Derrickson and Snyder (1992) recently recommended the following priciples to minimize the disease risks in captive populations of endangered species: (1) captive facilities should, whenever possible, be located in the species' natural range to reduce the chances of contacting exotic pathogens and parasites; (2) species should be housed in 2-3 geographically isolated, single-species facilities that are essentially "closed"; (3) the facilities should be staffed by individuals who are not simultaneously caring for taxonomically similar species; (4) facilities should be sited or designed to should be designed to prevent exposure to potential disease vectors; and (5) strict protocols for disease prevention and quarantine should be established and followed. The degree of adherence to the above precautions varies widely among existing captive breeding programs, but many endangered species are being held in circumstances where the potential for exposure to novel pathogens is high, i.e., outside of their native range in multi-species facilities.

Most propagation plans for endangered species call for the subdivision of captive populations for genetic, epidemiological, and logistical considerations (Foose et al. 1986, Lacy 1987). But although the risks of disease are theoretically reduced by subdividing populations among a number of facilities, this holds true only if the sub-populations are managed independently and exchanges between subpopulations are infrequent. In most cooperative breeding programs, animals are distributed among facilities as pairs or small groups. While this practice solves the problems of limited off-exhibit space and institutional requirements to maintain diverse collections, it also necessitates the frequent interchange of individuals between facilities to address genetic, demographic, or behavioral problems. Extensive population subdivision not only increases the risk of spreading cryptic diseases, but also reduces research and management options needed for securing sustained reproduction (Wilson et. al., in press).

Programs to translocate wild or captive-bred animals should include rigorous disease screening procedures to prevent the unwitting spread of pathogens and parasites, yet this precaution often has been ignored, thus placing wild populations at risk. For example, many reintroduced populations of Wild Turkeys *(Meleagris gallipavo)* in the mid-western United States are infected with an hematozoan parasite (*Plasmodium kempi*), apparently stemming from the translocation of infected wild birds (Castle and Christensen 1990). Similarly, present difficulties with an upper respiratory disease in wild Desert Tortoises (*Xerobates agassizii*) and Gopher Tortoises (*Gopherus polyphemus*) are believed to be traceable to the releases of infected individuals from captivity to the wild (Anon. 1989, Jacobson and Gaskin 1990, Jacobsen 1993). Following the discovery of widespread atoxoplasmosis in the captive population of Bali mynahs, the release program for this species in Indonesia was halted. Efforts are now underway to develop screening and treatment protocols, and to determine whether this pathogen is endemic in the wild population.

The potential disease risks faced by wild populations as a result of translocation was recently investigated Grifffith et al. (1993). In a survey of translocation programs of wild and captive-bred animals, they determined that the number of translocation programs for wild and captive-bred animals has nearly doubled in the past decade to over 700 per year. Animals in about 25% of the translocations in their survey were not even given a physical examination before release by a competent biologist or veterinarian. Under these circumstances, translocation and reintroduction programs clearly pose a serious risk of introducing infectious diseases into wild populations. Captive breeding programs without proper safeguards against disease transmission may actually serve to decrease, rather than increase, the security of endangered species (see Wilson et al., in press).

***Physical and Financial Requirements***

The numbers of species that could be housed in existing zoological institutions in minimum viable populations (MVP) have been calculated by Soule et al. (1986) at about 925 species, and more realistically by Conway (1986) at only about 500 species. Considering the total number of threatened and endangered taxa, these numbers are insignificant in the overall conservation of biodiversity.

The long-term costs of maintaining captive populations of vertebrates have also been estimated by Conway (1986). The costs are far from negligible, running from about $10,000 to $500,000 per year per MVP for species ranging from Caribbean Flamingoes (*Phoenicopterus ruber*) to Siberian tigers (*Panthera tigris altaica*). Annual programmatic costs for the captive breeding programs for the Puerto Rican Parrot and California Condor have been about $250,000 and $500,000, respectively (Derrickson and Snyder 1992). Because the captive populations of both of these species are not yet self-sustaining, annual costs will presumably be much higher when minimum viable sizes are attained.

One-quarter to one-half million dollars per year for a species summed over the 200 year maintenance period considered reasonable by Soulé et al. (1986) in their "millennium ark" proposal would total 50-100 million dollars per species. Sums of this magnitude would be more than adequate to purchase or restore large blocks of habitat that would suffice for the survival of many endangered species in the wild, and presumably would also preserve habitat essential for thousands of other plant and animal species sharing their ranges. For example, the 1300 $km^2$ Gray Ranch recently purchased by the Nature Conservancy in New Mexico may ultimately provide substantial habitat for a variety of endangered species and purchase costs will be about $25 million (G. Bonnivíer, pers. comm). Where such opportunities exist to preserve endangered species through habitat purchase or restoration, it is well to question the logic of pursuing long-term captive breeding.

During the past decade, over 238 organized breeding programs have been established by zoological institutions in North America, the British Isles, Europe, Japan, and Australia and New Zealand for long-term species survival, public education, and exhibition (Baker and George 1988, Bennett 1990, T. J. Foose, pers. comm.). Of these programs, approximately 70% have been developed for mammals, 27% for birds, and 3% for reptiles and amphibians. Because existing zoological institutions can only accommodate MVPs of an estimated 500-925 species (Conway 1986, Soulé et al. 1986), it is reasonable to conclude that the majority of space on the "ark" will continue to be devoted to mammals.

The move toward organized, cooperative breeding programs is a relatively new phenomenon in zoos and involves a major change in programmatic emphasis from the public exhibition of animal diversity to the intensive management of small populations. While major strides have been made in cooperative research, coordinated records keeping systems, and centralized administration, the extended captive management of MVPs for literally hundreds of species will be a logistically difficult and expensive undertaking involving unprecedented levels of commitment and inter-institutional and international collaboration. Because these logistical and financial constraints may be as formidable as all of the biological problems combined (Conway 1986, Foose et al. 1986), great care and selectivity should be exercised in establishing captive programs. I strongly support the view expressed by many (cf. Lande 1988, Meffe 1992, Frazer 1992, Rahbek 1993) that captive programs should not be implemented whenever simpler, more cost-effective preservation and restoration methods can be effectively applied.

*Administrative Continuity and Commitment*

Despite the gravity of the problems considered so far, the most serious impediment to success in long-term captive breeding efforts will probably lie in failures in administrative continuity and commitment. These are problems inherent in human programs and institutions, and cut across all cultures and political systems. While some of these problems can hopefully be resolved through increased cooperation, and creative organization and management (cf. Clark and Westrum 1989, Grumbine 1990), the individual and institutional commitments proposed in establishing the "millennium ark" are difficult to assess, since they extend beyond the immediate economic and social sphere. One can imagine sustained commitments being made for certain charismatic species, but it seems highly unlikely that such commitments will be made for the many other less glamorous species that will need captive support.

In my own limited experience in the past two decades with species conservation programs, I have witnessed serious, periodic deteriorations in the quality and commitment to programs for several endangered birds. Personnel involved in these programs have necessarily changed over time, and funding has waxed and waned without regard to programmatic requirements. I know of no reliable mechanism to ensure the continuity of efforts. This same problem, of course, afflicts all human endeavors and institutions, but the penalties for mistakes with endangered species programs are especially severe. The difficulties in guaranteeing long-term, quality efforts for endangered species strongly argue for all possible speed in achieving the recovery of wild populations.

## Advantages of Captive Breeding for Conserving Species

There are a number of important advantages for conserving species through captive breeding when efforts are properly integrated with conservation programs. First and foremost, captive populations can serve as an important safety net for species whose wild populations are small and fragmented, with a high probability of extinction. With species that breed readily in captivity, it is sometimes possible to greatly increase the rate of reproduction, through techniques such as multiple-clutching, and thereby speed the recovery of the wild



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population through the release of captive-bred animals. Theoretically, such releases into the wild can serve a number of purposes, including: increasing extant populations; correcting sex-ratio imbalances; infusing genetic variation; infusing new traditions; reestablishing extirpated populations; and/or establishing new populations in natural or altered habitats. Finally, captive animals can provide an important resource for fundamental research which cannot be accomplished on wild individuals.

Captive populations also have an important role to play in species preservation when pressures on wild populations are truly overwhelming in the short term and there is no way to sustain wild populations. This situation is probably less common than is generally believed, as some "hopeless" cases turn out to be rather more hopeful when imaginative research and conservation efforts are mounted. Nevertheless, truly hopeless situations, such as those faced recently by the California Condor (Snyder and Snyder 1989) the Guam Rail (*Rallus owstoni*) (Derrickson 1987c, see Savidge 1987) do occur. Captive breeding can provide a short-term reprieve for such species, buying time while the causes of their decline are ameliorated. The critical objective of such "rescue programs" should always be reestablishment of wild populations as soon as possible to avoid domestication effects.

When captive breeding programs are conducted within a species' native range, they can act as an important focal point for establishing subsidiary programs aimed at habitat preservation and restoration, public education, and research training (Durrell and Mallinson 1987, Mallinson 1988, Kleiman 1989, Butler 1992).

## When is Captive Breeding Appropriate?

Perhaps no other subjects arouse more emotional debate among conservationists than the questions of whether and when to employ captive breeding on behalf of endangered species. On the one hand, it is unwise to wait too long in starting captive breeding efforts, because the chances of success are greatly diminished when the wild population has already lost significant genetic variation as a result of drift and inbreeding. On the other hand, starting too soon can represent unnecessary expense and can sometimes focus resources in unproductive directions, preempting other approaches that may have more promise of success. In practice, the major disagreements tend to occur when there is a lack of enough knowledge about an endangered population to allow confident judgements about its potential viability and its prospects for recovery and reestablishment. Very often, only guesses are available as to the causes of population decline until careful studies are performed, and much too often studies are not initiated until a species is already in its final hour.

These issues can only be resolved through intensive biological investigations in the field. These investigations should be initiated before captive breeding or other conservation measures are implemented, and should be aimed at documenting life history characteristics, demographic parameters, and the causes of population decline. Because synergistic models which incorporate genetic, demographic, and environmental uncertainties are presently unavailable, estimates of population viability should be developed primarily on the basis of demographic rather than genetic factors (Lande 1988, Simberloff 1988, Grumbine 1990). In many cases, remedial actions can be prescribed which are much less expensive and more

likely to succeed than captive breeding. For example, thorough studies of the Bahama Parrot (*Amazona leucocephala bahamensis*) have shown clearly that there is no near-term need for captive breeding of this species, and that its conservation can best be served by such measures as education, preserve creation, selective predator control, and translocations to establish new populations (Gnam 1990). Nevertheless, it may be apparent in other cases that alternative conservation methods are unavailable, and that captive breeding may be a necessity for the near-term survival of the species.

Unfortunately, studies often are not begun until a species is all but lost, and there simply is not enough time to reach definitive judgements as to the reversibility of the causes of decline before the species will likely be gone. In such cases there may be no prudent course of action but to start efforts to establish a captive population simultaneous with intensive research of the remnant population, accelerating or decelerating the efforts to establish a captive population in a flexible manner, depending on information gathered. To the extent that a captive population can established initially through the taking of eggs or young, demographic impacts on the wild population can be minimized, leaving open the option for massive efforts to bolster the population if research indicates that this has a good chance of speeding recovery. This was the approach followed in the Puerto Rican Parrot Recovery Program, where the primary function of a captive population has generally been conceded to be a supportive one for the wild population (Snyder et al. 1987). A similar approach is being followed with the Mauritius Parakeet (Jones and Owadally 1988).

In contrast, intensive research into causes of the California Condor's decline eventually revealed that there was no reasonable way to achieve recovery of the remnant population. In this case, initial efforts to establish a captive population by taking of eggs and nestlings were followed by efforts to trap all the last wild birds to prevent further losses of genetic diversity (Snyder and Snyder 1989).

By the time that the introduced Brown Tree Snake (*Boiga irregularis*) was identified as the cause of the decline of Guam's avifauna (Savidge 1987), several endemic species were already extinct and the remaining species were declining precipitously. Captive populations of both the Guam Rail and Micronesian Kingfisher (*Halcyon cinnamomina cinnamomina*) were established on an emergency basis by capturing wild adults and, in the case of the rail, the collection of eggs and chicks as well. From the outset of these programs, the principal objective has been the reestablishment of wild populations (Derrickson 1987c).

In all of the above cases, high priority has been given to the reestablishment of viable wild populations in the near term, simultaneous with increasing the size of captive populations. In none of these cases is there any necessity to conclude at this point that permanent self-sustaining captive populations will prove to be advisable. If reestablishment efforts are sufficiently successful, the expense of maintaining captive populations can ultimately be foregone. However, if reestablishment is not successful, options still remain open for long-term captive breeding.

Wild populations should be reestablished as rapidly as possible to avoid behavioral and genetic deterioration in the captive environment. As a generality, captive breeding should be viewed only as a stopgap emergency measure that will eventually be phased out once wild populations are well on the way to recovery. Long-term captive breeding does not represent a viable approach for conservation either from a biological or human management perspective.

The implications of progressive genetic and behavioral change may well be considerably more serious than are commonly recognized in conservation biology. Proposals such as the now famous "millennium ark" for long-term preservation of species in captivity may, in fact, fail due to this problem. For many species, long-term preservation in captivity, despite all efforts to slow change will still result in domestication. It is sometimes argued that even if domestication cannot be avoided, domestic forms are still a worthwhile goal. But I would submit that we would not be preserving species or ecosystems by such an approach. Philosophically, it is well to question the value of such efforts and whether much more emphasis should instead be put into saving wild populations, crucial habitats, and ecosystems while they still exist. Moving into a massive "ark" mentality may distract us from implementing more difficult, but ultimately much more successful conservation approaches. To quote Conway (1988:263), "In the preservation of biological diversity, the use of technology is a last resort." Captive propagation should only be used as a last resort.

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Statement to the Subcommittee on Environment and Natural Resources of the Committee on Merchant Marine

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While headstarting has been viewed both favorably (Allen, 1992) and unfavorably (Woody, 1991) , I suggest that now is an appropriate time to reconsider the research value of the technique. The National Research Council (1990) recommended the continuation of sea turtle headstarting research, but only mentioned the Kemp's ridley project. The discontinued (Huff, 1989) but long-term Florida Department of Natural Resources (FDNR)(now Florida Department of Environmental Protection [FDEP]) project provided valuable data upon which to model headstarting (Witham and Futch,1977; Witham, 1991; Ehrhardt and Witham, 1992).

The recently discontinued (Byles, 1993; Williams, 1993) joint U. S. and Mexican "experimental" Kemp's ridley headstarting program received the most critical attention and Woody (1991) recommended discontinuing all such programs. Review of the methodology (e.g.,Klima and McVey, 1982; Byles, 1993) of this program shows that it was based upon the assumption that sea turtles "imprint" to the beach where they were hatched. The Kemp's ridley headstarting program involved taking eggs from Rancho Nuevo, Mexico. The eggs were hatched in Padre Island,

Texas beach sand and the resulting hatchlings were released on the Padre Island beach. The hatchlings were permitted to crawl to the surf where they were immediately recaptured for delivery to National Marine Fishery Service (NMFS) headstarting facilities in Galveston, Texas. While this experimental program included the study of various "...incubation and natal homing cues..." (Byles, 1993), no consideration appears to have been given to the possibility that sea turtles might learn about their geographical region nesting sites during their offshore swim. This oversight, in my opinion, was a major flaw in the Kemp's ridley headstart program (Witham, 1990). The release methodology for this program could have eliminated necessary nesting beach orientation cues.

The FDEP green sea turtle headstarting program always allowed the headstarted turtles to crawl a short distance down the release beach and then swim offshore. I reported (Witham, 1991) that the headstarted green turtles oriented into waves and swam offshore.

Heading into waves and swells during offshore swimming (Wyneken, Salmon and Lohmann, 1990; Salmon and Lohmann, 1989) could provide "imprinting" for a return migration to either the natal or a release beach. Such learning might involve a magnetic response (Lohmann, 1989).

While there is no direct evidence of a Florida headstarted green turtle returning to a Florida beach to nest, it has been suggested (Dodd, 1982) that increased nesting by the species in the state could be related to headstart releases. During the first years of the Florida program green turtle hatchlings from

Costa Rica were headstarted and released without tags. Meylan, et. al. (1990) suggested that the mitochondrial DNA similarity between Florida and Costa Rican greens could have resulted from the release of Costa Rican headstarted greens on Florida beaches. If true, this suggests that the Costa Rican green turtles learned the location of suitable Florida nesting beaches rather than their natal Costa Rican beach.

"Imprinting" in sea turtles needs further study. For example, it might be possible that the only imprint in these species is a within-species recognition system for future reproduction. Such an imprinting system might occur during hatching, emergence and/or seaward movement.

I believe that the increase in Florida green turtle nesting (apparent success of the FDEP headstarting program, which I developed) argues strongly for the need to continue research into the possible consequences (pro and con) of headstarting. Also, the responses of small sea turtles' to wave and swell cues during offshore swimming, combined with a magnetic orientation capability, are evidence that should encourage further research. We need to try to answer questions regarding how sea turtles relocate their nesting beaches, and determine if headstarting effects these choices.

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## FLORIDA (USA) TERMINATES 'HEADSTART' PROGRAM

In an effort to increase Florida's green turtle population, the Florida Department of Natural Resources (DNR) began a "headstart" program in 1959. Over 18,000 hatchling green turtles were raised in captivity for 6-12 months prior to their release to offset high initial mortality. Approximately a dozen facilities around the state participated in the program, with the House of Refuge in Stuart [Florida] serving as the main facility. Through recaptures of tagged turtles, the project has provided important data on the survival and growth of captive-reared turtles in the wild. Also, through public displays and releases, the program has had tremendous success in making the public aware of the endangered status of this species.

The ultimate success of the project, measured by increasing Florida's green turtle population, remains unknown. From the beginning, headstarting was recognized as experimental in nature. To our knowledge, no headstarted juvenile turtle has ever been documented to nest as an adult. This could be due to incomplete surveillance of nesting beaches, loss of tags, or because of the long time it takes green turtles to become reproductively active. It is also possible that the lack of nesting records could be evidence that there are fundamental problems with the practice. Possible interference with imprinting mechanisms that guide turtles to the nesting beach, imbalance in sex ratios from artificial incubation of eggs, nutritional deficiency problems from confined maintenance of hatchlings, and behavioral modifications are all potentially serious problems that are cause for concern.

Florida DNR considers that a sufficient investment has now been made in the first phase of the headstart program; i.e., collecting, rearing and releasing young green turtles. The intent now is to implement the second phase which is to await the return of headstarted turtles to the nesting beach. If significant numbers of headstarted turtles begin appearing on nesting beaches, the Department will consider continuing the program.

After the hatchlings from the 1988 nesting season are released, the Department will not be issuing permits to facilities for headstarting green turtles or any other species. The Department will continue to pursue other strategies to ensure the future of Florida's sea turtle populations. These include promoting the sea of Turtle Excluder Devices (TEDs) to reduce incidental mortality in shrimp trawls, increasing the protection of nesting beaches and foraging habitats, assisting with the implementation of lighting ordinances, providing standardized guidelines and training to sea turtle conservationists, and developing improved programs on beaches managed or owned by the State of Florida.

Florida DNR recognizes the important role of the headstart program has had in enlisting public support for marine turtles. Organizations that have been involved in the program are encouraged to utilize existing tank space for rehabilitating injured or sick turtles. The rehabilitation of turtles for release into the wild can be just as effective in educating the public about sea turtle biology and conservation.

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STATEMENT OF THE ENVIRONMENTAL DEFENSE FUND
BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND NATURAL
RESOURCES OF THE HOUSE COMMITTEE ON MERCHANT MARINE AND
FISHERIES

submitted by
THOMAS BUTLER AND MICHAEL J. BEAN

MARCH 1, 1994

In July of 1992, two of the most prestigious scientific institutions in the world, the National Academy of Sciences in the United States, and the Royal Society of Great Britain, issued a joint statement on the decline of biological diversity. The core of that statement was as follows: "At present, the only practical policy in conserving biodiversity must be to retain habitat." The primacy of habitat protection in efforts to prevent the extinction of species and the loss of biological diversity, however, is all too often overlooked in discussions of captive breeding. That oversight is perhaps explained by the fact that a few highly conspicuous successes have created the popular belief that captive breeding is an easy, well-established tool for rescuing and restoring species in peril of extinction. It may also be fueled by a desire on the part of some to divert attention from the real and urgent problem of habitat degradation by promoting a greatly exaggerated hope that we can find a painless way out of our endangered species dilemma through the quick fix of captive breeding.

Unfortunately, however, recent rigorous analyses of the history of captive propagation projects cast doubt on its practicality as a dependable method of ensuring the survival of threatened and endangered species. While some projects have been successful in reestablishing populations of rare species in their historic range, many more have been failures. In general, captive breeding is an extremely expensive and highly complex, species-specific process, the intricacies of which remain largely unknown to biologists. It is primarily for these reasons that captive propagation should be viewed as a potentially valuable tool in a rather

limited set of circumstances, rather than a panacea for the problem of conserving endangered species. It must be considered only one potential, unreliable resource in the complex process of preventing losses of biodiversity, and should be recognized as largely useless without the simultaneous protection of appropriate habitat for a species.

There are a number of prominent examples in which captive propagation of imperiled species has proven highly successful. With regard to some of the more majestic species' recoveries, both wood and plains bison roam small portions of their former habitats while bald eagles and peregrine falcons once again grace the skies of large areas of this country. The Aleutian Canada goose was downlisted from "Endangered" to "Threatened" as it's population was brought back from the brink of extinction. And black-footed ferrets are again living in the wild. For each of these species, captive propagation and reintroduction programs were used to help reestablish wild populations. This is not to say that such progress has been realized free of difficulties. Without the years of dedication from committed biologists and millions of dollars allocated to these efforts, all of these species would face a more uncertain future.

What these stories do not tell us, however, is the remarkable number of plants and animals for which captive propagation has not been a success. For endangered species, captive propagation is rarely if ever, an end in itself. Rather, its purpose is to produce a supply of animals (or plants) for reintroduction into the wild. Yet, in a 1989 article on translocations, Griffith, Scott, Carpenter, and

Reed assert that projects they surveyed involving "threatened, endangered, or sensitive [animal] species" had a meager 46% success rate (Griffith et al., p.477). A later study on the reintroduction of captive born animals by Beck, Rapaport, Stanley Price, and Wilson reports even more drastic findings: of all animal species introductions surveyed (not just imperiled species), only 11% were successful in reestablishing stable, self-supporting populations in their historic habitat range (Beck et al., p.273, 278). And finally, William Allen indicates in a 1994 BioScience article that plant reintroduction projects have met similarly unsuccessful fates. Of 45 plant reintroduction projects undertaken in California in the last ten years, only 4 (8.4%) were complete successes (Allen, p.66). To further drive his point home, Allen cites a 1991 British Nature Conservancy study which found that only 22% of the 144 plant reintroductions they surveyed were considered successes. Certainly, then, attaining successes in translocations, reintroductions, and captive breeding, particularly of endangered or threatened species, is far from an exact science. Such figures indicate very clearly not only that captive propagation and reintroduction are unreliable tools in the recovery of species' populations, but also that the majority of such projects result in failures.

In general, these failures must be attributed to the remarkable complexity of the problem at hand. Recognizing the intricacy of developmental biology, ecosystem interactions, and animal behavior, biologists have begun to experiment with different ways of making captive breeding and reintroductions simulate natural processes as much as possible. One particularly illuminating example is

the "headstart" program for the Kemp's Ridley sea turtle experiment. In this program, young turtles are hatched and reared on Padre Island, Texas from eggs removed from natural nests on the beaches at Rancho Nuevo, Mexico. Once hatched, the young turtles are "imprinted" to Padre Island by being allowed to crawl from the beach into the ocean. In the ocean, however, they are recaptured and maintained in captivity for the first year of their lives, after which they are tagged and released. Despite remarkably high percentage of successful rearings and releases (87.1% over 12 years), not a single headstarted turtle has been recorded returning to Padre Island for nesting, nor has any such turtle been found on any other beach (Eckert et al., p.1). Clearly something is wrong with the project, the only difficulty is finding out what that problem is. A 1992 review of the headstart program identified several different areas in which the program's design could be improved to better the results. Determining which design flaws could be held responsible for the complete failure of the experiment, on the other hand, was far more challenging.

The primary problem to resolve was that in 12 years no headstarted turtles had ever come back to the beaches to nest. It was unclear to the review team, however, whether the turtles had not nested, or whether they had, and had gone unnoticed. Detecting nesting turtles, however, requires trained individuals to monitor as much of the beach as possible during nesting season. During the 1989 nesting season, only 50% of the nestings at Rancho Nuevo were observed (Eckert et al., p.4). It could be, then, that headstarted turtles had nested, but had gone

unobserved. But this too is difficult to prove, as tagging techniques which have no adverse effects on the turtles either have short life spans, are difficult to identify, or require special equipment for identification, depending on the type of tagging involved (Eckert et al., p.4). In light of these factors, it seems very difficult to determine whether the turtles are not nesting at all, or if researchers just have not been able to identify them when they do. And if the latter is true, is it because of an inability to observe enough of the nestings, or because of deficient tagging designs?

The review team also found that the experiment lacked a control group against which to compare the headstarted turtles. Without such a control it would be impossible to determine whether the headstarted turtles are faring better in the wild than naturally hatched turtles. In order to create a control group, however, a reasonable number of wild turtles would need to be marked upon hatching and before entering the sea. These turtles too would be identified upon return to the beach for nesting. In addition to the very same difficulties the researchers had with tagging and identifying headstarted turtles, tagging wild turtles would then double the number of turtles needed to be marked and identified--a costly, labor intensive reform to say the least. Clearly, captive rearing of the Kemp's Ridley sea turtle has resulted in a high rate of hatchlings. But such a captive rearing success is essentially useless if it cannot be determined whether the released turtles are augmenting the natural population.

Making such a determination is going to prove extremely costly, and it may not, in fact, be determined at all.

The problems that were found in the Kemp's Ridley sea turtle program were design flaws in the experiment, but complexities in captive rearing and reintroduction projects go far beyond just design flaws. Biologists attempting to captive breed the black-footed ferret face potential genetic difficulties. The ferret's numbers had dropped to such a low level when captive breeding was begun in the 1980's that all of the ferrets in existence today (around 200) have remarkably similar gene pools. This can cause severe problems. For example, one genetic disease could essentially wreak havoc on such an inbred population. Similar conditions exist with the whooping crane population, which once numbered a mere 21 birds, the California condor population, whose numbers fell to 27 individuals in 1987, the Puerto Rican parrot, which reached a low of 13 individuals at one point, and the Hawaiian crow, or alala, whose population numbers only 24 individuals (FWS).

Small gene pools, however, are not the only impediment to the recovery efforts of the California condor. Captive propagation efforts for this species have proven problematic at every stage. Having captured all remaining wild birds in 1987, finally, in 1992, the captive population was large enough that biologists felt secure in attempting a reintroduction program (FWS, 12/92). Methods for release were rigorously tested on Andean condors, turkey vultures, black vultures, and golden eagles, before any attempt was made with the California condors (FWS,

12/92). Between 1992 and 1993 eight condors were released, after first having gone through acclimation procedures. By the end of 1993, three of the condors were dead. One drank anti-freeze from a leaking car, and two were electrocuted on power lines (FWS, 5/93). It seems that the condors, having been raised in wire cages and been used to man-made structures, did not exhibit the prudence and precaution necessary to survive in a habitat scarred with the presence of man. Thus, behavioral differences between captive reared and wild birds can have a dramatic effect on the ability of a species to prevail in the wild.

In the case of whooping crane propagation, as with almost all critically imperilled species, complications outside of genetic considerations exist as well. Whoopers raised in captivity, like the condors, also seem to have lost some of the behavioral patterns necessary for survival in the wild. Captive reared birds are having a difficult time learning to fend for themselves, forage, and mate. This problem has been addressed with a variety of different training programs including foster parenting from sandhill cranes, nurturing from breeder parents in enclosed wild settings, and staged attacks from training dogs and people. None of the programs, however, has proven itself invaluable. For example, whooping cranes being raised by foster sandhill parents do not seem to recognize other whoopers as potential mates, and thus far have not realized successful reproduction in the wild--an unforseen complication extremely difficult for biologists to rectify. Also, in one of the last captive releases, fourteen trained whoopers were set free in a protected area in Central Florida. In spite of both the

staged attacks in their training and the FWS having removed bobcats from the release area twice, four of the cranes were eaten by the cats (FWS, 2/93). Beck et al. report on many other "pre-release training" or "acclimatization" programs, but indicate that evidence to support their effectiveness is limited (Beck et al., p.268, 276). In the end, both the Beck et al. study and the Griffith et al. study stress that far more documentation and research are necessary in the fields of captive propagation and reintroduction because as the Beck et al. study indicates, "only with research-based improvements in techniques will reintroduction attain the success and applicability to threatened taxa needed to gain credibility as a recovery strategy" (p. 281)

Despite their complex biological and design difficulties, these experiments in captive propagation and reintroductions have allowed biologists to distill some of the factors that make successes more, as well as less likely. Both the Griffith et al. study and the Beck et al. study conclude that reintroduction programs are more likely to succeed when using a large number of animals released to the wild over a long period of time. The Griffith study further indicates that herbivores translocate more easily than carnivores or omnivores, species which breed early in the season and have many offspring are also more successful, and translocation of wild caught animals were more successful than captive reared ones (p.478). The Beck et al. study of captive rearing and reintroductions revealed that when the programs were accompanied by community education and employed locals, the success rate was higher (pp.281-282).

By far the overriding factor that is associated with the success of captive propagation programs and subsequent reintroductions, however, is the presence of protected, quality habitat in the present or historic range of the species. As Griffith et al. put it, "without high habitat quality, translocations have low chances of success regardless of how many organisms are released or how well they are prepared for the release...Identification and retention of adequate habitat will require a combined species and ecosystem approach. Regional approaches to maintaining diversity will be essential to ensure that existing species and habitat assemblages are identified, their interactions are understood, and remnant habitats are protected" (p.479). This point cannot be overemphasized.

A review of some of the already mentioned successes of captive breeding and reintroduction illustrates just how vital habitat protection actually is. One of the success stories cited was the case of our national symbol, the bald eagle. Both the bald eagle and the peregrine falcon underwent labor intensive and costly captive propagation and reintroduction programs. These two species are now considered to be well on their way to recovery, as the bald eagle is a candidate for downlisting, and the peregrine falcon's range and numbers have grown consistently in the last two decades. But can these successes be attributed to captive propagation and reintroduction efforts? There can be no doubt that these efforts have facilitated recovery in many areas, but the essential first step in that recovery was the banning of DDT in 1972. The presence of high levels of DDT in the these birds in the 1960's and 1970's (and to a lesser degree today) caused

their eggshells to thin. With such thin eggshells, the reproductive capacity of these birds plummeted, putting them on the brink of extinction. Without the banning of DDT, captive breeding and reintroduction programs for the bald eagle and the peregrine falcon would have been utterly pointless.

Bald eagles and peregrine falcons are by no means the only examples of species for which captive breeding programs could not have succeeded without prior or simultaneous habitat enhancement or protection. The eastern brown pelican was delisted in 1985 from its "Threatened" status in major sectors of its range. Despite reintroduction programs for the pelican, the Fish and Wildlife Service attributes its recovery also to the elimination of DDT (FWS, 3/85). Another example is the Aleutian canada goose. This subpopulation of canada goose was downlisted from endangered to threatened in 1991. The Aleutian canada goose, like the bald eagle and the peregrine falcon, underwent intensive captive propagation and reintroduction programs. Interestingly, however, the FWS does not cite this as a major reason for the recovery of the bird. Instead it cites the removal of introduced arctic foxes from the goose's former breeding ground, and the protection it and its habitat received along its Pacific coast wintering grounds (FWS, 1/91). Such a list could on, but Dr. Ray C. Erikson, former assistant-director of one of the most active and advanced captive propagation centers in the world, the Patuxent Wildlife Research Center, concisely and clearly summarizes the role of captive breeding within the larger spectrum of imperilled species protection: he emphasized that "captive

propagation is not intended to substitute for but to complement the preservation and management of natural habitats and the enforcement of regulations to protect species" (FWS, 11/77). Without a doubt, habitat protection must be the first priority in the preservation of threatened species, and captive propagation can only be considered as a potential additional measure.

Here, it is worth noting that there have been instances in which captive propagation was the focus of a recovery attempt--and without the essential measure of simultaneous habitat protection. The result in the case of the Amistad gambusia was devastating. This small Southwestern fish's only home was a tributary to the Rio Grande. By the time it's tributary was completely inundated by the construction of a dam, the fish was thought to be extinct in its native habitat--it was only known to exist in captivity. Tragically, an unexplained accident occurred and all of the specimens held in captivity were lost. The fish is now extinct. The Service announced it's removal from the endangered species list, formally recognizing its extinction in 1988 (FWS, 1/88). Its fate is a forceful reminder that captive propagation is a very risky and inexact science.

Captive breeding can be an important component of conservation strategies for imperilled species. It is already being used extensively by the Fish and Wildlife Service as part of the recovery programs for many endangered species. It is, however, no panacea, and its potential contribution to the recovery of endangered species is often poorly understood and greatly exaggerated by the public. Congress should continue to entrust to the scientists responsible for

implementing the endangered species program the responsibility to determine if, and when, it is appropriate for any particular species.

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CAYMAN TURTLE FARM (1983) LTD.

TESTIMONY
OF
JAMES R. WOOD, JR.
MANAGING DIRECTOR
CAYMAN TURTLE FARM (1983) LTD.

BEFORE THE
COAST GUARD AND NAVIGATION SUBCOMMITTEE
COMMITTEE ON MERCHANT MARINE AND FISHERIES

U.S. HOUSE OF REPRESENTATIVES

MARCH 1, 1994

Mr. Chairman and Members of the Subcommittee:

I am James R. Wood, Jr., Managing Director of Cayman Turtle Farm (1983) Ltd. (CTFL), a commercial green sea turtle farm in the Cayman Islands. I have worked with sea turtles for the past 24 years receiving my Ph.D. in 1974 from the University of Arizona with a research specialty in sea turtle nutrition. I joined CTFL in 1974 as research manager and in 1983 became the Managing Director. I am pleased to have the opportunity to give my testimony in support of continued efforts in captive sea turtle propagation.

INTRODUCTION:

Captive sea turtle propagation as a tool for conserving sea turtles can only be evaluated by asking two questions: Is captive breeding and subsequent captive rearing of the offspring feasible? Do captive bred animals released into the wild contribute to the conservation of the species in the wild?

IS IT FEASIBLE?

Our experience at CTFL in captive breeding and rearing of sea turtles almost exclusively pertains to the green sea turtle, *Chelonia mydas*, and the Kemp's or Atlantic ridley sea turtle, *Lepidochelys kempii*. The green turtle was first captive bred at CTFL in 1973 with captive reproduction occurring in each successive season. The Kemp's ridley was first captive bred at CTFL in 1986 with further successful reproduction occurring each year thereafter.

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A summary of the captive breeding results achieved at CTFL through the 1993 season is given below (green sea turtle unless otherwise noted):

| Type of female | # of eggs set | # of hatchlings | % Hatch |
|---|---|---|---|
| Captive wild | 686,369 | 204,590 | 29.9 |
| Captive hatched and raised | 151,823 | 9,378 | 6.2 |
| Captive conceived, hatched and raised (F1) | 11,737 | 208 | 1.7 |
| Kemp's ridley, captive hatched and raised | 9,120 | 2,475 | 27.1 |

Obviously, for green turtles, breeding stock consisting of wild caught adults gives a higher percent hatch than stock which has been hatched and raised in captivity. Since the number of eggs laid per female is essentially the same, overall production by wild caught adults is greater. It may be that with increasing knowledge the reproductive performance of captive bred and reared breeders will be improved. There is some evidence to suggest that green turtles in the wild may not become sexually mature for 30 or more years. If this is true, it may be that the captive hatched and raised greens will become more reproductively proficient with increasing age. Our current information based on the age at which a farm reared female first nests suggests that greens can begin laying at around 12 years of age while ridleys begin nesting at an average age of 8 years. It is interesting to note that the hatch rate of the farm reared ridleys is only slightly lower than that of the captive wild green turtles and much higher than the captive hatched and reared greens. This may reflect the proposed younger age of sexual maturity for the ridleys or indicate that in regards to captive breeding the ridley is better adapted to a captive environment.

Cost of both green and Kemp's ridley hatchlings at CTFL is approximately US$10.00 each. On average for each female in the breeding pond 74 green or 23 Kemp's ridley hatchlings will be produced each year (about 46% of the greens and 60% of the Kemp's ridleys will nest). While these figures seem insignificant, a breeding herd consisting of 100 male and 100 female Kemp's ridleys would produce on average 2300 hatchlings a year at a cost of $23,000. Considering the extremely endangered status of this species, this number of hatchlings, if used to their full potential, could have a significant impact upon the number of adult Kemp's ridleys in the wild.

DOES IT WORK?

The objective of non-commercial captive breeding of sea turtles would be to ultimately release the resulting offspring into the natural environment. Generally these offspring would be held in a captive environment for some period of time (headstarted) before release. The theory being that older animals will suffer less predation than hatchlings when released into the wild.

Since 1980 CTFL has released some 27,995 captive bred green turtles into local waters. Of these 16,422 were day old hatchlings while the remaining 11,573 averaged approximately 14 months of age. Many of the hatchlings had received living tags (autografts of plastron shell to the carapace) but no other tagging method was used. Yearlings released between 1980 through 1983 were notched in one marginal scute but were otherwise not tagged. Yearling releases from 1984 to the present used a titanium tag with an offer of a reward made in Spanish. These titanium tagged releases number 6,959. CTFL's tag returns for the period 1984 to 1991 were recently published (Wood and Wood, 1993). For this period and representing 5959 titanium tagged yearlings, 271 tags had been returned. Returns were both local and foreign. Foreign returns have been primarily from Cuba however a few returns have been from Honduras, Panama, Nicaragua, Venezuela, Mexico, Belize and the United States. The majority of local returns have been obtained by a tag and recapture program of CTFL using nets in local waters with the captured animals being released after data collection. Of the returns 54% have been local with 46% being foreign. Because of the local tag and recapture program, the majority of local captures are young animals averaging only 5.5 months in the wild since release. Foreign returns, which are usually the result of an organized fishery, average 30.6 months in the wild from day of release. Weight gains for local recaptures averaged 3.04 kg/year while foreign recaptures averaged 7.83 kg/year. This difference being primarily one of age at recapture. Rate of growth of local recaptures is approximately 50% of that achieved in captive culture while growth rates of the foreign returns are about 80% of that in captivity.

Head starting is controversial. Much of the controversy stems from the criteria used to evaluate the success or failure of headstart programs. Most opponents of headstarting hold the view that, in order to be deemed a conservation benefit to the wild population, headstarted animals must be shown to become a part of the reproductive adult population.

Headstarting programs have tended to emphasize the release of hatchlings or turtles of 8 to 14 months of age. This is certainly true of the release program at CTFL, the Florida program and the Kemp's ridley release program which was conducted at Galveston, Texas. It has been correctly stated that neither these nor any other headstart program have even been able to demonstrate that a wild breeding population has been augmented by headstarted released animals. There are several possible reasons for the failure to

demonstrate that headstarting works. Many of the animals released in the past have had inadequate tags which remained on the animal for only a short time making it impossible to identify the animals at a later date. This problem becomes more severe when one considers that it may take 20 to 30 years for a turtle to become sexually mature in the wild. It may be, however, that the survivability of yearling turtles is simply so low that few, if any, have actually survived to sexual maturity. If this is the case then consideration should be given to headstart programs which emphasize the release of large, older animals, perhaps even turtles which are sexually mature at the time of release.

The release of older animals or "superheadstarting" has been discussed but never undertaken on any significant scale. Although such a program could conceivably be beneficial to any of the sea turtle species, it has particular merit in regard to the Kemp's ridley. The Kemp's ridley is without question the most endangered of all the sea turtle species.

For example, 1000 Kemp's ridley hatchlings obtained from a captive breeding program could be raised for one year and released. Assuming a 70% survival this would yield 700 yearlings at a cost (based on our experience at CTFL) of approximately US$50 to $60 each. Rearing a hatchling during the first year is the most labor intensive and costly period of development. This is especially true for the Kemp's ridley which, due to their very aggressive nature must be maintained in separate containers for the first 6 to 12 months. It is also true that the majority of mortality will occur during the first 12 months. In essence, after rearing the Kemp's ridley to the yearling stage, the hard work is done. At this time the animals can be maintained together in relatively dense concentrations making maximum use of labor and available facilities. If these yearlings were raised for an additional 6 years with an assumed additional mortality of 10% of the initial hatch then there would be available for release 600 adult or subadult males and females. Total cost of these 60 to 70 lb animals would be approximately US$150 to $200 each. If even 10% of the 300 females became a part of the nesting population this would be a significant benefit to this population.

CONCLUSION:

Although the process is not perfect and there is still much to learn, CTFL has proven the feasibility (both biological and economical) of captive breeding and rearing of the green and Kemp's ridley sea turtle. Data accumulated from the CTFL release program clearly show that a significant number of captive reared green turtles are capable of adapting to and surviving in the wild environment.

Captive propagation and headstarting are not a panacea for all that ails the world's sea turtle populations. Efforts must still be directed to protecting the sea turtle in the wild, particularly in maintaining the natural habitat of the various sea turtle species.

I do feel, however, that captive breeding and headstarting can be developed as a valuable tool and contribute to the conservation of sea turtles in the wild. I therefore urge support for the establishment of sea turtle propagation centers and for headstarting programs, particularly "superheadstarting" programs.

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TESTIMONY OF THE COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION
BEFORE THE SUBCOMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES
OF THE MERCHANT MARINE AND FISHERIES COMMITTEE
CONCERNING CAPTIVE PROPAGATION TO ASSIST LISTED SPECIE
HEARING ON MARCH 1, 1994

Mr. Chairman, members of the Committee, my name is Ted Strong and I am executive director of the Columbia River Inter-Tribal Fish Commission. As you may know, the Commission was formed by the Yakama Indian Nation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe for the purpose of coordinating fishery management policies and providing technical expertise. The Commission greatly appreciates the opportunity to provide testimony on this issue because of its great importance to the exercise of our member tribes' treaty fishing rights in the Columbia River.

In its testimony before the Committee, NMFS describes its use of captive propagation of Snake River sockeye as a last resort for recovery purposes while stating that the agency believes that effective recovery of listed salmon populations "requires substantial changes to the primary activities that have caused the species decline -- the Columbia River Basin hydropower system, watershed habitat management, and fish harvest."

The Commission believes that the NMFS policy on captive propagation will lead to the gradual extirpation of listed salmon stocks as well as other salmon populations given that NMFS is unwilling and unable to require radical modifications to the activities that have caused the listed populations' decline; in other words, to recreate the pristine conditions that were in effect at the time of our treaties, 1855. We believe that NMFS has found that the problem for listed Snake River salmon populations is that habitat loss and overfishing has resulted in fragmented and isolated populations; their solution is to maintain fragmented and isolated populations. The Commission further believes that the NMFS policy:

1) Is contrary to the clear language of the ESA and instead takes a narrow and unscientific view of report language regarding genetic conservation;

2) Relies upon a novel but highly controversial concept of salmon population dynamics (the ESU) that utilizes electrophoretic molecular measurement as its chief determinant; and

3) Is biologically unsound because it is likely to complicate the problems of fragmented and isolated populations that resulted in the need for ESA listings.

The NMFS policy on captive propagation requiring that

artificial propagation be limited to captive breeding for an entire generation is a severe and unwarranted interpretation of the Endangered Species Act.

The ESA (16 U.S.C. 1531 et. seq.) was enacted in 1973 in recognition that:

1) Various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth untempered by adequate concern and conservation (sec. 2(a)(1)); and,

2) "these species of fish, wildlife, and plants are of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people (sec. 2(a)(3))

The purposes listed in the Act make no mention of protecting genetic diversity. Instead the Act was intended to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such . . . species" and to achieve the purposes of various wildlife treaties. (sec. 2(b))

The Act further defines the term "conservation" as meaning "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act no longer necessary. Such methods . . . include . . . propagation, live trapping, and transplantation (emphasis added)."

NMFS, under its ESU policy, has severely restricted the use of either adjoining populations of the same species as broodstock for propagation efforts or of hatchery populations of the same populations for donor broodstock on the basis of conserving genetic diversity. Yet NMFS's only direct support for its contention that the purpose of the ESA is to conserve genetic diversity comes from a remark in a 1973 House Report on the ESA which stated:

> It is in the best interests of mankind to minimize the losses of genetic variations. The reason is simple: they are potential resources. They are keys to puzzles which we cannot yet solve, and may provide answers to questions which we have not yet learned to ask.[1]

The Report further elaborated on this statement discussing a

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[1]H.R. REP. NO. 412, 93d Cong., 1st Sess., (1973) (cited in Notice of Policy, 56 Fed. Reg. 58612, (1991) and in Robin Waples, *Pacific Salmon,* Onchorynchus spp., *and the Definition of "Species" Under the Endangered Species Act,* 53 MARINE FISHERIES REV. 11, 12 (1991)).

critical chemical in the regulation of ovulation found in a common plant or the loss of the blue whale as examples of potential resources. Neither example can be compared to preserving the genetic variation between populations of the same species that originate from streams whose headwaters are within one mile of each other. For instance, NMFS is currently attempting to restrict the release of hatchery-reared fish in the Grande Ronde River of Oregon that originated primarily in streams that originate within a mile of the headwaters of the Grande Ronde and flow into the Snake.

The Commission supports the conservation of genetic diversity. But, even if NMFS could demonstrate that conservation of genetic diversity or adaptive differences was an overriding purpose of ESA, the method it uses to measure genetic diversity, electrophoresis, does not associate biochemical differences with important, genetically-based characteristics such as adaptive traits. Nor does it consider the degree to which a population represents a historical population. In summary, the NMFS policy utilizes a very narrow view of genetic diversity that is not necessarily consistent with the values that the ESA was designed to protect.

While listings under ESA may not necessarily serve every value the statute was designed to promote, a policy which inhibits recovery will not serve any of those values. For instance, salmon serve a keystone or foundation role in salmon ecosystems because of the immense amount of nutrients they bring back to their natal streams from ocean foraging. By prohibiting or severely limiting propagation and transplantation through the ESU policy, NMFS is failing to support the ecological values that salmon bring to stream ecosystems.

NMFS artificial propagation policy for salmon is based upon the "Evolutionarily Significant Unit" policy for determining whether stocks of Pacific salmon qualify as "species under the ESA.[2] The attached article entitled "Managing Molecules or Saving Salmon? -- The "Evolutionarily Significant Unit" explains the Commission's views on why this policy is biologically incompatible with the recovery of salmon populations in the Columbia River Basin under the Endangered Species Act.

The use of propagation, transplantation, and live trapping in conjunction with habitat protection and enhancement are entirely compatible with the clear language of the Endangered Species Act and have been the basis for the successful recovery efforts of such species as alligators, greenback trout, and peregrine falcon. To deny the use of these methods in a manner that minimizes risk to genetic diversity is not only opposed to the provisions of ESA and the biological requirements of species conservation, it is also a severe impediment to the exercise of treaty fishing rights that

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[2]Notice of Policy, 56 Fed. Reg. 58612 (1991).

were guaranteed by the United States in our treaties.

The Commission appreciates the opportunity to comment on the NMFS policy and would be glad to respond to Committee questions.

# Managing Molecules or Saving Salmon? -The "Evolutionarily Significant Unit"

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ABSTRACT

The purpose of the Endangered Species Act is to revitalize animal and plant populations on the brink of extinction and to protect the ecosystems that support them. The act has provisions to preserve habitat and develop a recovery plan. The act allows for protection of a biological species, a sub-species, or what the act calls a distinct population segment. Federal listing policies can hamper actions to restore extirpated or weak fish stocks.

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## Introduction

Sockeye and chinook from the Snake River, the Columbia's largest tributary, have been listed for protection under the Endangered Species Act. But many of those committed to helping save Columbia River salmon question whether the National Marine Fisheries Service (NMFS) will effectively use the act to rebuild the salmon species now facing extinction. They fear that a recovery plan will be too many years in the making and that it and other protective measures will not be enough. They also worry that scientific debate and uncertainty over questions about "species" definitions and the role of genetics will be used to slow or even sabotage salmon restoration. This article describes what some of that debate is about and what the implications are for Columbia Basin salmon.

## Species Definition

A widely accepted scientific definition of a species is derived from the biological species concept which emphasizes that members of the same species interbreed. In other words, for most animals and many plants, a species is a group whose members breed within the group, but do not usually breed with members of other groups. A biological species is said to be reproductively isolated. (Templeton 1989).

Within a species there are no major differences in genetic composition nor in characteristics strongly controlled by genes. Minor differences may occur, and a group exhibiting those different characteristics may be classified as a sub-species. Such differences often arise because of geographic separation. When geographic separation continues and (genetic) differences increase, a sub-species may evolve traits that enforce reproductive isolation. At this point, a subspecies may be recognized as a new species.

Zoologists do not officially recognize groups below the subspecies level (Stace 1989). However, it is often desirable and useful to recognize groups such as races and varieties. The terms refer loosely to minor differences within a species, for example, stocks of salmon. The variety or race is often recognized by ecological characteristics, such as differences in the migration timing of spring, summer, and fall chinook.

The Endangered Species Act also allows for protection of a "distinct population segment." Under the act, a distinct population segment can be protected using a wide range of criteria (geographic, economic, aesthetic, political, biological among others), provided group members can interbreed when mature. Because Congress defined "distinct population segment" in only very broad terms, the National Marine Fisheries Service (NMFS) felt obligated to establish a policy that would explain how "distinct populations segment" applied to Pacific salmon (Waples 1991).

In 1991 NMFS (56 F.R. 58612) declared that a distinct population segment would be recognized only if the interbreeding population met two criteria: "(l) It must be substantially

reproductively isolated from other conspecific [in the same species] population units, and (2) It must represent an important component in the evolutionary legacy of the species." The federal fish agency designated such a group an "evolutionarily significant unit," or ESU.

Unfortunately, rather than explain DPS, the new definition has generated a quagmire of confusion and illogic. In the case of Columbia Basin salmon, reproductive isolation, the definition's first criterion, is difficult to evaluate. After over a century of habitat degradation and passage blockage, the few remaining populations are small and greatly fragmented. The isolation we now observe may not be natural, but an artifact of "civilization." Furthermore, countering this isolation is the tendency of salmon to stray into new areas and produce progeny that return there to spawn. In any event, the fact of geographic isolation does not necessarily indicate reproductive isolation.

The second criterion, evolutionary importance, is vague and highly subjective. Does it refer to genetic material in salmon species descended from salmon of the 1850s? Or to present-day genetic material of importance to the future success of a species? Does it refer to differences in life history and body form? Does it mean something measured in the genes or in the environment?

Add to these ambiguities the problem of the ESU definition being nearly the same as the species definition. According to NMFS, an ESU is characterized by reproductive isolation and by uniqueness (evolutionary significance), which are the same considerations used in defining a species. Once a salmon population is determined to be an ESU, what has been identified, according to the definition, is more like a species than a group below the species level, such as a distinct population segment.

## Electrophoresis Is Used to Identify ESUs

In practice, NMFS relies almost exclusively on genetic testing to predict evolutionary significance and reproductive isolation in determining whether a salmon population is an ESU. Using electrophoresis, NMFS scientists differentiate populations by comparing the proportion of individuals in each population according to particular types of proteins. They reason that the larger the differences in these proportions of proteins, the longer the time of reproductive isolation. The agency's scientists infer that populations presumably isolated for a long time are likely to have developed unique characteristics that must be protected. The same results can occur when a common historical population undergoes a series of genetic bottlenecks and population fragmentation as depicted in Figure 1.

However, predicting evolutionary significance from minute differences in protein composition is largely speculative: there is no known way to associate biochemical differences with important characteristics, such as length of reproductive isolation or adaptive traits, and no way to correlate the degree to which a population represents a historical population.

Despite these and other problems with electrophoresis, NMFS not only relies on it, but exacerbates these problems by using electrophoretic results inconsistently: When NMFS scientists used protein analysis to study Snake River spring, summer, and fall chinook, they found a 0.005 genetic difference between fall chinook and spring/summer chinook. Based largely on these results, Snake River fall chinook were found to be an ESU and were listed as threatened. Snake River spring/summer chinook were also listed, but lumped together as one ESU because test results showed a magnitude of difference between spring chinook and summer chinook of less than 0.005. (Apparently, springs and summers are not sufficiently reproductively isolated.)

When NMFS scientists examined the genetic material from lower Columbia River coho, they again detected a 0.005 genetic difference--this time between coho spawning in streams and those that were spawned in hatcheries. Despite this finding, the federal agency determined that lower river wild or naturally spawning coho possessed no distinct evolutionary legacy (NMFS 56. F.R. 29553). Thus, NMFS did not provide Endangered Species Act protection for the few remaining lower Columbia River wild coho.

The federal fish agency made this decision on coho even though its own scientists acknowledged that coho exhibit lower rates of variability in electrophoretic tests. (In other words, the difference could have been smaller, but still significant in terms of the uniqueness value NMFS was testing for.) These natural runs of lower Columbia River coho could not be evolutionarily significant, according to NMFS (56. F.R. 29553), because "the extent and duration of [hatchery] releases suggest that naturally spawning populations in these streams are mixtures of the native and introduced hatchery stocks."

ESU Compromises Genetic Diversity

Snake River sockeye provide a different kind of example. These sockeye were found to be evolutionarily significant and were listed as endangered. NMFS scientists did not base the decision on electrophoresis because there were too few Snake River sockeye to study. Instead the agency based its decision largely on the presumption that these sockeye were genetically unique because they swim far inland to high altitude lakes.

"Sockeye," the biological species, are relatively abundant in other portions of their historical range, for example, in the far inland Okanogan and Wenatchee watersheds as well as other places from Washington to Alaska. Yet the recovery effort is focused on breeding the three males and one female Snake River sockeye that returned to Redfish Lake in 1991. Because NMFS identified these four sockeye as an ESU, it concluded that they could not be bred with any other Columbia Basin sockeye. To breed them with other basin sockeye would result, NMFS implied, in hybrid fish that are no longer unique nor evolutionarily significant. Apparently this means that if the Snake River sockeye run cannot be recovered from the few remaining fish, it simply dies out.

The offspring of these sockeye--and a male that returned this year--will be held in two hatcheries as part of a captive breeding program. The resulting progeny will not be released into the river to migrate, but will be kept in captivity for their entire lifespan to increase their chances of surviving and producing offspring. Theoretically, at a future date when the population reaches some, as of yet, undetermined numerical and biological strength, the resulting offspring from the captive breeding stock will be re-introduced to their natural habitat.

Limiting this endeavor to the progeny of a few sockeye has enormous genetic risk. When a population is subject to inbreeding because of severely restricted numbers over a protracted period, as Snake River sockeye have for the past 50 years or more, a great deal of genetic diversity is lost. (Geneticists call this a genetic bottleneck, see Figure. 1.) To limit broodstock for recovering the Snake River sockeye to four plus fish is to further restrict that diversity. Small populations possess little genetic variability and are therefore at great risk of extinction because of inbreeding and/or the inability to deal with environmental changes over time. Many potential genetic problems face small populations. Those problems include increased juvenile mortality due to inbreeding, loss of genetic diversity through founder effect and genetic drift, the physical expression of deleterious recessives, interaction of demographic and genetic effects, and inadvertent selection for domestication (Ralls and Ballou 1986). Although not a genetic risk factor, a single catastrophic event--a power outage, for instance--could also wipe out an entire captive population.

The genetic diversity that enables a salmon species to persist over time is found within the whole range of that species. Trying to keep the genetics of salmon static in a rapidly changing environment, as NMFS' captive breeding program is attempting, works against natural evolutionary processes. Only by providing a species with its full genetic diversity might it then be able to adapt and survive under changing conditions. For a population that has experienced severe genetic bottleneck, the added diversity from inter-breeding with other populations (hybridization) can provide that advantage.

## Hybridization Is a Natural Occurrence

For a time, the U.S. Fish and Wildlife Service had an official policy against hybrids. The agency abandoned the policy in 1990 (FWS. CW. 0440), after finding "new biological information [that] casts doubt on the validity of the absolute pronouncements relied upon [earlier], since in some cases introgression between taxa is not only a naturally occurring phenomenon but may also be a necessary recovery measure to avoid the loss of a seriously depleted listed taxon."

In a March 1991 Science article about the Endangered Species Act, the founder of the biological species concept, Dr. Ernst Mayr, and his associate, molecular biologist Dr. Stephen J. O'Brien, emphasized that "living organisms are constantly evolving and that over time hybridization may result in new, unique species." Mayr and O'Brien pointed out that, in the case of endangered or threatened species, a ban on hybridization between sub-species or

populations may in fact disrupt that important natural process.

This is particularly true for salmon. Having survived for thousands of years and through radically different environments, salmon have developed some highly successful reproductive characteristics (Thorpe 1986) that have fostered an exceptional degree of natural hybridization: Salmon possess remarkable migratory ability and range; yet they are susceptible to straying; and they will colonize new and reclaim former habitats. These behaviors have allowed them to breed with numerous other populations.

Yet NMFS seems to be saying that an ESU cannot include hybrids. If a population, designated as an ESU, were to breed with another population, the federal fish agency would no longer recognize it as evolutionarily significant for purposes of the act.

## Hatchery Fish and Genetic Diversity

In addition, according to NMFS' final determination on Snake River chinook, a hatchery fish "should not be considered part of the evolutionarily significant unit for listing purposes." Presently no hatchery fish, only populations spawning in nature, can be considered of evolutionary significance. Thus, spring chinook of Rapid River Hatchery origin are currently excluded from protection or use in Endangered Species Act recovery efforts even though they are all that remain of the spring chinook that historically spawned in the Snake River above Hells Canyon Dam.

The federal fish agency has acknowledged, however, that, "it is important to address whether any existing hatchery population can be considered part of the evolutionarily significant unit, and therefore potentially be used in recovery efforts." A determination will not be made until the agency issues a final decision on the role of artificial propagation in carrying out the Endangered Species Act.

NMFS scientists are worried about unwisely altering the genetic composition of fish stocks. However, hatchery technologies can be used to ameliorate such risks. The act itself specifically endorses conservation methods such as artificial propagation and "transplantation" to recover imperiled animals or plants.

Actual experience shows that many crosses of wild and hatchery salmonids have exhibited hybrid vigor. In fact, the scientific literature on breeding across various genetic lines suggests that hybrid vigor--not reduced survival--is the general rule (Wohlfarth 1986). When environmental conditions change, hybrids often do better than their parents. These offspring have greater genetic diversity and thus have a greater potential of fitting into a fluctuating environment such as the Columbia River system.

Because, under the NMFS' definition of evolutionary significance, a species is recognized as a group possessing unique genetic information, the goal becomes not the restoration of populations to healthy, productive levels by maintaining genetic diversity and robustness,

but the preservation of very small, highly inbred and supposedly wild populations that represent mere fragments of historical salmon runs.

Implications for Habitat Protection

The NMFS captive breeding program relies on very gradual increases from such low starting numbers that, at best, it will take decades to rebuild the threatened and endangered Snake River salmon runs. A sad consequence of such an extended timeline is its potential use as a rationale for indefinitely postponing habitat restoration and protection. There is less incentive to revive and maintain healthy lakes and streams in the Snake River Basin (and elsewhere) when no significant numbers of fish are going to be put back in these waters for years to come, if ever.

By excluding segments of the salmon populations, NMFS policies and practices may actually hasten the loss of the very populations we are fighting to save. By concentrating on the study of protein molecules, the agency is losing sight of the bigger basinwide problem of salmon depletion.

While looking through the wide end of the telescope, the ESU policy fails to recognize the role of salmon in the ecosystem. Highly migratory species in general and salmon in particular are to aquatic ecosystems as rain is to the hydrologic cycle. They are a biological link between ocean and freshwater ecosystems. Abundant and diverse salmon runs are required for the productive life of many oligotrophic lakes and streams. Salmon are vital food source for many species, including humans, and for the Northwest's indigenous peoples, salmon also provide cultural sustenance.

What may be the most alarming related development in the Columbia Basin is the institutionalization of ESU as the operational philosophy for fish restoration--whether or not the salmon runs in question are listed under the Endangered Species Act. Such a development could prevent rather than aid salmon recovery.

The ESU approach is similar to a trend in current state and federal habitat and fish production policies in which managers operate on the basis of remnant fish run management. As with the ESU policy, this kind of management deals with fragmented populations as if each were the historical population. For example, because each dwindling fish run is considered separate and distinct, none is acceptable as broodstock for supplementing fish runs elsewhere in the basin. In this way, managers think they are preserving genetic uniqueness.

Many regional business and political leaders also seem satisfied to support the preservation of a smattering of Columbia River salmon as a reminder of something called "our wild heritage." However, under remnant run (or ESU-style) management, the numerous, small and isolated fish run fragments will continue to be threatened by inbreeding and vulnerable to local extinction from environmental and natural disasters.

In fact, the curious logic of remnant run management and genetic scare tactics have already been used to delay, if not stop, tribal plans to use artificial propagation technology to increase naturally spawning salmon populations in the Columbia River above Bonneville Dam.

Few others, except the Indian Tribes, now emphasize restoring large viable salmon runs at "usual and accustomed" locales throughout the Columbia Basin. To the Indian people, this lack of concern is nothing new. For more than a hundred years, they have watched as others have decimated the resource as a tradeoff for "progress."

If the region is ever to recover large viable salmon populations, it cannot do so by relying on current NMFS preservation policies. An alternative approach with real potential for success would emphasize genetic diversity and the use of all the appropriate genetic materials and management tools available. It would likely involve the introduction of some genetic material from outside the existing local populations. While there are some risks, such an approach would improve the odds for rebuilding salmon populations that can adapt and survive in the natural environment.

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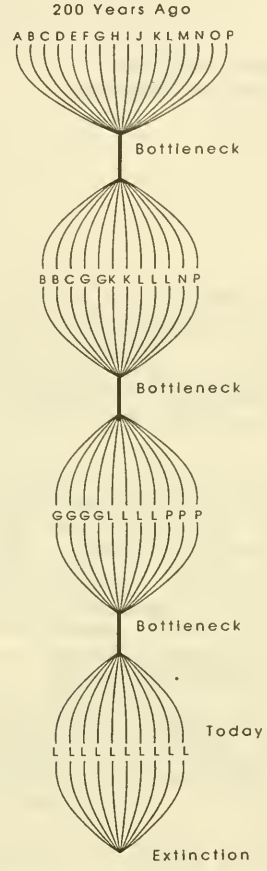
Figure 1. A schematic representation illustrating what can happen to the genetic diversity of a salmon run over time as a result of genetic bottlenecks. The letters represent different genetic characteristics. The resulting fragmented populations appear to have different ancestries. Bottlenecks are severe population reductions caused by human induced and/or natural changes such as habitat destruction. (Adapted from O'Brien and Evermann (1988).


200 Years Ago
A B C D E F G H I J K L M N O P
Bottleneck
B B C G GK K L L L N P
Bottleneck
G G G G L L L L P P P
Bottleneck
Today
L L L L L L L L L L
Extinction

Adapted from TREE Vol.3, No.10, October 1988

March 8, 1994

Honorable Gerry E. Studds, Chairman
Merchant Marine and Fisheries Committee
Environmental Subcommittee
545 FHOB
House of Representatives
Washington,D.C. 20515

Dear Chairman Studds,

As you consider reauthorization of the Endangered Species Act, I would like to comment on the role of captive breeding in the recovery of endangered species. As a zoologist with over twenty years of involvement in endangered species conservation, specifically in developing breeding programs for captive populations, I feel my views are in line with those of many conservation biologists working with captive populations of endangered species.

It is generally accepted that the role of a captive population is to reinforce the survivability of the wild population. This is the view of the American Zoo Association and IUCN Captive Breeding Specialist Groups. The establishment of a captive population is one prong in a many pronged approach in recovering endangered species. By making use of all the available resources - habitat procurement, legal protection, reproductive technologies, genetic augmentation and population expansion, a species has a better chance to recover, become self-sustaining and eventually be down-listed.

The establishment of a captive population for an endangered species is like opening a genetic savings account. Important genetic pedigrees remain protected in a safe place and can be accessed anytime to bolster the wild population. The main purpose of a captive population is to preserve options. By maintaining a representation of the genetic variability found in the wild in captive animals we can chose how and when to use that material to help secure the survival of the species in the wild.

It is crucial that most of the effort to recover a species goes to habitat protection and procurement. However, in order to be prepared for the worst case scenario other options should exist. In this regard, a captive population also functions as a

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population of last resort. When a captive population is properly established and managed it can help weather the persecutions of habitat loss, disease, and human eradication practices. In fact, recently we have seen the successful reintroduction of several species that no longer existed in the wild with animals that came from long term captive breeding programs. Most notably among these are the red wolf, black footed ferret, and the California condor. In these cases a captive population gave us the option of starting over. After reviewing the causes of the decline in the wild, technical experts could develop a new strategy and using captive-bred animals, try again.

Captive populations serve another important function in that they can be the source of animals to start additional populations of endangered species in areas where there is better habitat or they can be better protected. I have been working with the recovery team for the Florida panther since 1987. We have established a genetically representative captive population and are now working to establish a second population of panthers in north Florida. This technique is also being used to try to establish a non-migratory population of whooping cranes in Florida using stock produced in captivity. The conservation community is learning how to condition captive raised animals to live in the wild and we are starting to have some successes such as with the aforementioned species.

The maintenance of a captive population does not need to compete with efforts to save a species in the wild. In fact, it can strengthen the efforts needed to get the public involved and behind protection programs. Captive animals can become ambassadors for their species evoking concern for their species' plight among people who encounter them. The public relations value of a captive population to motivate people to care and to help is a fact that cannot be overlooked. Through educational promotions the attention of the public can be brought to bear on lawmakers, public officials, and private citizens to recognize the needs of a species and how and why habitat must be preserved in order to save it.

Captive populations that are established early on in the decline of a species and are scientifically managed will be self-limiting when used as an integral part of a species recovery effort. The diverse contributions that the captive population can make to the recovery of a species can help bring an animal back from near extinction in a short length of time. Once a species is secure in the wild, the only animals that should be left in captivity are those that are unreleasable.

During your deliberations, remember the dusky seaside sparrow that went extinct while people squabbled over habitat use. A last ditch effort at captive breeding failed because only six males were all that could be found remaining in the wild. They lived out their days in captivity with no chance of continuing their kind. If an approach that included the

establishment of a captive population at the first signs of trouble had been tried, along with habitat preservation and legal protection, maybe this species would still be a resident of the freshwater marshes of Florida. These days in Florida we are much better at protecting and managing our wetlands and if there was a captive population of dusky seaside sparrows left there now would be protected habitat available where they could be reestablished.

I urge you to re-authorize the Endangered Species Act and to make sure that all the resources that are available to help endangered wildlife will be made available to those entrusted with carrying out the mandate of this most important act.

Sincerely,

John A. Lukas

John A. Lukas
Director, White Oak Conservation Center

cc: Honorable Tillie Fowler

# CHICAGO HERPETOLOGICAL SOCIETY

*Affiliated with the Chicago Academy of Sciences*

2001 North Clark Street • Chicago, Illinois 60614


February 25, 1994

RECEIVED

MAR 0 7 1994

COMMITTEE ON MERCHANT MARINE AND FISHERIES

Representative Gerald Studds
Chairman: Subcommittee on the Environment
and Natural Resources
United States House of Representatives
Washington D.C.

RE: National Marine Fisheries Service (NMFS) Kemp's Ridley Headstart Program

Dear Representative Studds and Committee Members:

We understand that Carole Allen of H.E.A.R.T. will be testifying before your committee in March of this year on behalf of the NMFS Kemp's ridley headstarting program. Although many CHS members have been long-time supporters of the headstart program and of H.E.A.R.T., it is our position that it would be unconscionable to use restarting the headstart program as an excuse to relax Turtle Excluder Device (TED) regulations or their enforcement.

As is the case with all species of turtles, continued survival of adult turtles of both sexes is critical to the survival of the species as a whole. In nature, with no human interference, turtle eggs and hatchlings have only the slimmest chance to reach adulthood. If a female turtle digs a nest and lays 100 fertile eggs, on average less than one will hatch, reach the ocean unharmed and survive to sexual maturity. The very reason turtles have evolved to produce so many eggs is the enormous odds against any one egg resulting in a successful member of the breeding pool. Any reduction in the number of breeding adults eliminates hundreds of chances that the species will continue to reproduce.

Shrimp trawling has had a devastating effect on all sea turtle populations. We are aware that generations of shrimpers have been making their livings in this manner. However, if wildlife on this planet is to survive, we all must change our methods of using natural resources. If this Congress and Administration are serious about wildlife conservation, and sea turtle conservation in particular, then rather than relaxing TED regulations or their enforcement, the committee should recommend that such regulations and their enforcement be strengthened. Every shrimp trawling net used, not only during peak shrimping season, but throughout the entire year, must be equipped with a TED.

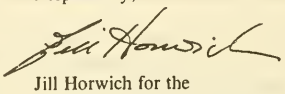
The Blue Ribbon Panel appointed to evaluate the NMFS headstart program in 1989 reported that "... it is presently impossible to determine if headstarted ridleys are recruited into the natural breeding pool because the shrimp-trawl induced mortality rate of Kemp's ridleys (both wild and headstarted) is so high that few if any headstarted ridleys are expected to reach sexual maturity ...." There is no point in continuing with any measures to save the ridleys from extinction as long as shrimp trawlers are permitted to operate without using TEDs.

We are aware that there have been many reports on the Kemp's ridley headstart program, both positive and negative. We agree with the September 22–23, 1992, *Review of the Kemp's Ridley Sea Turtle Headstart Experiment* that stricter controls should be designed to monitor the program. We also agree that given a limited amount of money available, more funds should go toward monitoring every single nest on the only Kemp's ridley nesting beach at Rancho Nuevo. We also note that research done by André M. Landry, Jr., Professor of Marine Biology and Co-Director, Institute of Marine Life Sciences, Texas Institute of Oceanography, Texas A&M University at Galveston, has begun to show that headstarted ridleys do become integrated into the wild population. We have not, however, had an opportunity to review Dr. Landry's research.

Given all the information we have been able to obtain to date, we would like to see the NMFS headstart program continued if at all possible, with more emphasis on monitoring the nesting beach in Mexico. More importantly, however, we feel TED regulations and their enforcement should be strengthened. Once again, as long as shrimpers use nets without TEDs, it is only a matter of time before the Kemp's ridley and almost every other species of sea turtle become extinct. If this committee recommends that the headstart project be resumed at the expense of TED regulation enforcement, it is effectively endorsing the wholesale destruction of all sea turtles.

Thank you for your consideration.

Respectfully,



Jill Horwich for the
Chicago Herpetological Society

cc. Ms. Carole Allen, H.E.A.R.T.
Dr. Deborah Crouse, Center for Marine Conservation

DOCUMENTS SUBMITTED TO THE SUB-COMMITTEE ON THE ENVIRONMENT AND NATURAL SOURCES RELEVANT TO THE TESTIMONY OF CAROLE H. ALLEN
HELP ENDANGERED ANIMALS-RIDLEY TURTLES
March 1, 1994

Letter from I. T. Saito, Chief, Branch of Permits, Office of Management Authority, FWS, dated July 19, 1993, NMFS Regional Director Andrew Kemmerer
Memorandum from Charles W. Dane, Chief of the Office of Scientific Authority, FWS dated July 15, 1993

Executive Summary (Page 14) from Decline of the Sea Turtles, Causes and Prevention
Pages from the Recovery Plan for the Kemp's Ridley Sea Turtle
Letters from the National Park Service; Dr. Jack Frazier of CINVESTAV, Yucatan, Mexico, and Pat Burchfield for Rancho Nuevo turtle camp requesting funding

Eggs and hatchlings data from NMFS, FWS and National Park Service (NPS)

(Letters from sea turtle experts supporting headstarting.)
Dr. David Wm. Owens, Texas A&M University, Team Leader of the Kemp's Ridley Recovery Plan committee
Dr. Sammy M. Ray, Coordinator of Community and Youth Programs, Texas A&M University at Galveston
Dr. Thane Wibbels, Chair of the 1989 Blue Ribbon Committee Panel, Science Magazine Letter to Editor
(Letters from Dr. Andre Landry, Institute of Marine Sciences, Texas A&M University, Galveston, listed below.)

"Turtle Devices Allegedly Sewn Shut" from Galveston Daily News, December 6, 1993
"Recreation Fishing Group Seeks Ban on Bay Shrimpers," Houston Chronicle, February 3, 1994

NOAA 1986 Annual Report for Head Start Research Project confirming correction of egg incubation to produce more female Kemp's ridleys

NOAA 1989 Annual Report for Head Start Experiment Blue Ribbon Panel recommendation to continue

Articles published in the *Marine Turtle Newsletter*
"Guest Editorial: Give 'Headstarting' A Chance," Carole Allen, 1990
"Panel Review of Kemp's Ridley Headstart Program," Dr.Thane Wibbels, 1990
"Kemp's Ridleys are Rarer Than We Thought," Dr. Peter C. H. Pritchard, 1990
"It's Time to Give Kemp's Ridley Headstarting A Fair and Scientific Evaluation!" C. Allen, 1991
"NMFS to Concentrate on Measuring Survivorship, Fecundity of Headstarted Kemp's Ridleys in the Wild," Phil Williams, NMFS, October 1993

"International Efforts in the Conservation and Management of the Kemp's Ridley Sea Turtle, Jack B. Woody, from the Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management, 1985

"Kemp's Ridley Sea Turtle," Audubon Wildlife Report 1986, Jack Woody, FWS

FAX to NMFS Director of Protected Species asking for appeal of FWS decision
Research from Institute of Marine Life Sciences, Texas A&M University, Galveston, Texas, with new information for appeal and two letters from Dr. Andre Landry
Letter from Representatives Jack Fields, Solomon Ortiz and Billy Tauzin asking for NMFS to appeal the FWS decision not to issue CITES permit

"Feds Chop Head Start For Turtles," July 21, 1993, Houston Chronicle article
Galveston Daily News editorial, August 8, 1994

Letters from Mexican officials: Secretary to President Carlos Salinas de Gortari; Consul General Francisco Gonzalez de Cossio of Houston; and FIS. Sergio Reyes Lujan of the National Institute of Ecology

Acknowledgements from Senator Phil Gramm, Representative Craig Washington, Vice President Al Gore, Representative Jack Fields, Texas Land Commissioner Garry Mauro, Representative Jack Brooks and Representative Kika de la Garza

Correspondence regarding Freedom of Information Act request from HEART, Carole Allen, to NOAA for information about headstarting.

"Federal agencies undermining efforts to save ridley sea turtle," Houston Chronicle, December 22, 1991
"Chelonian Communique" by Jill Horwich from the *Bulletin* of the Chicago Herpetological Society, 1993
Article from *The Lamp*, Exxon Company Publication, 1992

Letters of support for headstarting
Houston Audubon Society President Gary K. Woods
Houston Underwater Club, Inc.
Judith K. Odell, Teague Middle School science teacher, Humble, Texas
Principal Pat Reynolds, Oak Creek Elementary, Houston, where first HEART Council was formed
Wanette, Oklahoma, Elementary School teacher Sharon Gray
Letters and drawings from Parker Elementary, Galveston, Texas

"Sea Turtles In a Race for Survival," by Anne and Jack Rudloe from the *National Geographic,* February 1994.
Letter of support for headstarting and TEDs from Dr. Marc D. Graff, Vice-Chair of the California Turtle and Tortoise Club, the largest turtle conservation organization in the world.

## IT'S TIME TO GIVE KEMP'S RIDLEY HEAD-STARTING A FAIR AND SCIENTIFIC EVALUATION!

Woody (1991) has proclaimed himself judge, prosecutor and jury for all Kemp's ridley sea turtle (Lepidochelys kempi) research and management, without applying the same principals of professional and moral ethics, proven techniques, and biologically sound rationale that he expects of head-starting. Help Endangered Animals-Ridley Turtles (HEART) believes that the head-start experiment in Galveston, Texas, should be continued. This opinion is supported by the recommendations of the National Marine Fisheries Service (NMFS) Blue Ribbon Panel (Wibbels et al., 1989a), the National Academy of Science's Committee on Sea Turtle Conservation (Magnuson et al., 1990) and, to a lesser extent, the NMFS-FWS [Fish and Wildlife Service] team of scientists who prepared the draft "U. S. Recovery Plan for the Kemp's Ridley Sea Turtle", although we are opposed to the Recovery Plan's low priority ranking and suggested cutbacks regarding head-starting. Some of the scientists who served on these committees are world-renowned, including Karen Bjorndal, Nat Frazer, Mark Grassman, John Henrickson, René Marquez, David Owens, Peter Pritchard, James Richardson, and Thane Wibbels.

The head-start experiment began in 1978, but a majority of males were released by the program through 1984 (Shaver et al., 1988; Wibbels et al., 1989b). By 1985, enough data on the relationship between incubation temperature and sex ratio were available to understand that elevated temperatures would produce mostly females. In an attempt to balance past ratios, mostly females were produced beginning in 1985. The Kemp's Ridley Recovery Team estimates age at sexual maturity to be 15 years for this species. Consequently, not many head-started ridleys would be expected to nest before the year 2000. Nonetheless, some head-started ridleys may already be reproductively active. Woody (1990, 1991) offered no proof that head-started ridleys are not currently nesting at Rancho Nuevo (Mexico) or Padre Island (Texas). Nesting takes less than an hour (Pritchard and Marquez, 1973), and neither Rancho Nuevo nor Padre Island is patrolled well enough to observe every turtle. If they were, the number of nesters would not have to be estimated from the number of nests (Pritchard, 1990). If a head-started female loses her tag, how is she to be identified as head-started? Some of the turtles with only tag scars at Rancho Nuevo may, in fact, be head-started individuals.

Woody (1991) cited altered behavior in mentioning the head-started Kemp's ridley caught offshore Nicaragua (Manzella et al., 1991). Maybe if as many *wild* juvenile ridleys as *head-started* juvenile ridleys (in the latter case, about 18,500) had been tagged and released since 1978, some would have been found in places Woody thinks Kemp's ridleys should not occur. Bolten and Martins (1990) reported wild Kemp's ridleys near Madeira and the Azores, but Woody (1991) overlooked these, choosing instead to base his conclusions about altered behavior in head-started turtles from a few tag returns and rare sightings, ignoring the hundreds of head-started ridleys found in the Gulf of Mexico and east coast [USA] habitats where wild ridleys also occur (Manzella et al., 1988; Fontaine et al., 1989). Meylan et al. (1990a) didn't speculate that the Kemp's ridley nesting in Florida had been head-started, but Woody (1991) did, and went on to make a point about its possible altered behavior. However, green sea turtles (Chelonia mydas) sometimes make the same "mistake" due to imperfect homing (Meylan et al., 1990b). Sweat (1968) found an adult Kemp's ridley from Rancho Nuevo in south Florida waters, so why shouldn't Kemp's ridleys nest in Florida and other areas? How else do sea turtles colonize new nesting beaches?

Based on tag returns, NMFS monitors the head-started turtles for growth, survival and movement (Manzella et al., 1988; Fontaine et al., 1989). Most of the tag returns are from live and dead strandings and shrimp trawling. Caillouet et al. (1991) reported that sea turtle

strandings are directly correlated with shrimp fishing effort, so we all should know by now what is killing our turtles, be they wild or head-started. Twenty five years of Rancho Nuevo beach protection has not measurably increased the number of nesters, so Woody (and other detractors; e.g., Mortimer, 1988) should suspect some common cause preventing both wild and head-started turtles from surviving long enough to nest at Rancho Nuevo or anywhere else . . . and that cause is shrimping (Magnuson et al., 1990; Wibbels et al., 1989a). It makes sense that we allow the head-starting experiment to continue until we can fairly evaluate it under the conditions of full implementation of Turtle Excluder Devices (TEDs) in all trawls in the Gulf of Mexico and U. S. eastern seaboard. Finally, Woody's (1991) comparison of "per hatchling" costs is incorrect. The Rancho Nuevo hatchlings estimated to cost US$ 0.65 each don't all live through their first year. The cost of producing *yearlings* from eggs laid at Rancho Nuevo cannot reasonably be compared with the cost of releasing hatchlings directly from the nesting beach.

The Mexican and U. S. governments would not have initiated head-starting if removing 25 clutches from the beach each year jeopardized the intended recovery of the species. The take was then, and is now, considered by program officials to be insignificant. Crouse et al. (1987) concluded that eggs and hatchlings are not nearly as valuable to sea turtle populations as large juveniles and adults. This is not to say that eggs do not have value, but removing 3% of annual egg production has not been shown to be detrimental to the population at large. We can only assume that Jack Woody and others who initially planned and implemented the head-start experiment did not do so just because of public appeal or political motivations, but rather based their program on the premise that 2,000 eggs per year was an acceptable experimental take. Today the experimental head-start program generates tremendous public support for sea turtle conservation, as well as for the increasingly beleaguered Endangered Species Act (ESA). This support contributed heavily to TED regulations and to the reauthorization of the ESA in 1988.

Head-starting was planned as a ten year trial, but, in August 1989, the NMFS Blue Ribbon Panel recommended a ten year extension after TEDs were fully implemented on shrimp boats (Wibbels et al., 1989a). While the Panel's recommendations may not have been peer-reviewed, they were certainly not kept secret. Anyone interested, including Jack Woody, could have requested a copy of the report from the NMFS office in St. Petersburg, Florida. In closing, I am very disappointed by Woody's (1991) biased interpretation of the results of head-starting endangered Kemp's ridley sea turtles. The Federal Register announced that the draft Recovery Plan for the Kemp's Ridley Sea Turtle was available about the same time Woody circulated his critical review of head-starting (Woody, 1991). He was promoting the burial was head-starting before giving the public a chance to comment on the NMFS-FWS Recovery Plan. Supporters of sea turtle conservation, HEART, and those involved in the head-start experiment have made their voices heard. I hope the readers of the MTN will also make their support for Kemp's ridley head-starting known.

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Marine Turtle Newsletter

March 9, 1994

To Gerry Studds
Chairman
Subcommittee on Environment and Natural Resources

Subject: Status of Kemps Ridley Sea Turtle

As a high school science teacher with a masters degree in Wildlife Science, I am writing to you to express my views on the program to help save the endangered Kemps Ridley sea turtle. I have been involved with this program through HEART (Help Endangered Animals Ridley Turtles) for the past ten years. I have spent parts of four summers on the nesting beach at Rancho Nuevo, Mexico helping with that end of the experiment to help save this species as well as speaking engagements in the Houston area and participating with the open house at the National Marine Fisheries Lab in Galveston. I have also testified at National Marine Fisheries Service hearings on the subject of the Ridleys.

My major concern is the continuation of the experiment to save this species in the most scientific way. When I heard that the United States was not going to receive the hatchlings from Mexico for the 1993-94 year, I could not understand this about-face by some of the scientists who helped write the recovery plan for this species. In their decision to not headstart turtles at Galveston, they seem to have stopped the experiment in the middle, maybe just when results could be showing up at Rancho Nuevo One of the reasons that I heard for not continuing the experiment was that there was no control group for the experiment. I am assuming that the hypothesis was to give some baby turtles a headstart at Galveston so that they could increase the nesting population. These scientists knew at the onset that this experiment was going to be a long one, where results may not be collected for up to twenty years. If they needed a control group to compare this to, why not use unmarked nestlings released at Rancho Nuevo. If headstarting worked then we could compare the number of new nesting females as to whether they were marked or not. I urge this committee to look into the continuation of headstarting at Galveston.

It has also been brought to my attention that some members of the shrimping community would like to headstart seaturtles instead of using TEDs (Trawling Efficiency Devices). Even though most shrimpers will not admit catching sea turtles in their shrimp nets, it has been proven that this is the major source of sea turtle mortality. Headstarting more turtles may be a good idea, but to do this in lieu of TEDs is not valid. Why pay money to raise the sea turtles to a larger size in captivity and release them to be caught and drown in the next week, month, or year in a shrimp net.

I feel sorry for some in the shrimping community because their livelihood seems to be in jeopardy, however, I think that any shrimp loss due to TEDs is minor compared to the loss they are suffering because of habitat destruction in the high density shrimp areas. Not only are shrimp nets destroying habitat along the ocean and bay bottoms where they are pulled, they are also indiscriminately catching many other organisms in their path. I think that the bycatch issue particularly saltwater sportfish and commercial gamefish will further decrease their shrimp catch when these organisms must be excluded from shrimp nets in the future. There are only a finite number of shrimp and other species produced along the seacoasts of the world, and as more and

more people try to use these resources, they are going to become depleted and result in more restrictions. I think that this is where the shrimping industry is at the present time.

As a teacher, I try to involve my students in the political process. They have written letters to legislators and in most cases have received a reply. They have learned the way the government is supposed to work from the textbook, however, there are times when it does not work that way. The recovery plan for the Kemps Ridley called for headstarting for a few more years, and the students and I cannot understand how a few scientists can change what was decided by that team of scientists.

I realize that budget problems are facing lawmakers and that cuts are going to have to be made. I also realize that turtles and other organisms do not vote, but people do. We have many problems in the United States and it seems like when push comes to shove that natural resources get more cuts than other areas.

I appreciate your time and hope that you will consider continuing the headstarting program until scientific results are conclusive about its effectiveness and then make the determination to continue or cancel it.

Sincerely,

Al Barr

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